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AND
ANIMAL OECONOMY;

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Discoveries, which have been made in the ANIMAL
OECONOMY, gradually traced to the present Time.

W I T H T H E

ART of injecting and making ANATOMICAL PREPARATIONS.

V O L. III.

Omne tulit punctum, qui miscuit utile dulci.

HOR.

By CHARLES NICHOLAS JENTY, M.A.
Professor of ANATOMY and SURGERY.

L O N D O N,

Printed for JAMES RIVINGTON and JAMES FLETCHER, at the
Oxford Theatre in Pater-Noster-Row. MDCCLVII.

THE
LAW
OF
THE
STATE
OF
NEW
YORK
IN
RELATION
TO
THE
PRACTICE
OF
THE
COURTS

AND
THE
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A
C O U R S E
O F
Anatomical Lectures.

L E C T U R E I.

Of the LIPS, MOUTH, and GUMS.



Y the MOUTH, we mean, first, that transverse Slit, between the Nose and Chin, formed by the Lips; and, secondly, it expresses the internal Cavity of which this transverse Slit is the external Opening.

The external Parts of the Mouth are, the Lips, &c. the internal are, the Gums, Palate, Septum Palati, Uvula, Amygdalæ, Tongue, the Membrane which lines the whole Cavity of the Mouth, the salival Ducts, Glands, and the Bottom of the Mouth. We may also reckon, among the internal Parts of the Mouth, the Muscles therein.

The LIPS form the Sides and Entry of the Cavity of the Mouth. They are formed, in general, by the Connexion of several musculous Portions, of different Breadths, fixed round the convex Sides of the two Maxillæ, covered on the exterior Side with the Skin and Fat, and lined on the interior Side by a glandulous Membrane: Besides all these, the Lips seem likewise to have a soft spongy Substance in their Composition, which dilates and contracts, on certain Occasions, independent of the Action of the Muscles belonging to them, and is mixed with Fat.

The Substance which forms the red Border of the Lips, is very different from the rest of the Skin, being a Collection of very fine, long, villous Papillæ, closely connected together, and covered by a fine Membrane, which seems to be both a Continuation of the Epidermis, and of that Pellicle which covers the glandulous Membrane of the Cavity of the Mouth.

This Substance is extremely sensible, and very painful, when the external Membrane is, by any Accident, destroyed: The internal Membrane of the superior Lip forms a small middle Frænum above the first Dentes Incisorii.

The Gums are that reddish Substance, like Leather, which covering the two Sides of the alveolary Border of both Maxillæ, insinuates itself between all the Teeth, surrounds what is called the Collar of each Tooth, in particular, and adheres very strongly to them: Therefore the exterior and interior Gums are continuous, and, both together, form just as many Openings as there are Teeth.

The Substance of the Gums is of a very singular Structure, resembling, in some measure, the Texture of a Hat, supposed to be very compact and elastic. It is not immediately fixed to the Bones of the Maxillæ, but by the Intervention of the

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the Periosteum, with which it is perfectly united; and it is covered by a fine, strong, uniform Membrane, which sticks very close to the Substance of the Gums, and seems to be a Continuation of that thin Membrane which goes to the Lips and Cheeks, and of that which goes to the Tongue.

The Arteries which go to the Lips, Cheeks, and Gums, are Ramifications of the external Carotid, and chiefly of those Branches called Maxillares Externæ and Internæ; the Veins are Ramifications of the external anterior Jugular.

The Nerves of these Parts come from the Maxillaris Superior and Inferior, which are Branches of the fifth Pair; and also from the Portio Dura of the auditory Nerve, or Sympatheticus Minimus, the Ramifications of which are spread, in great Numbers, on all these Parts, and communicate, in a pretty singular Manner, with the Nerves of the fifth Pair, in several Places, as may be seen in the Description of them.

OF THE PALATE, UVULA, &c. The PALATE is that Curvature or Cavity of the Mouth surrounded anteriorly by the alveolar Margin and Teeth of the superior Maxilla, and reaching thence to the great Aperture of the Pharynx; this Curvature is partly solid and immoveable, and partly soft and moveable: The solid Portion is that which is bounded by the Teeth, being formed by the two *Ossa Maxillaria*, and two *Ossa Palati*; the soft Portion lies behind the other, and runs, posteriorly, like a Veil fixed to the Margin of the *Ossa Palati*; being formed partly by the common Membrane of the whole Curvature, and partly by several muscular Fasciculi, &c.

The Membrane that covers all this Cavity is like that which lines the superior and middle Portions of the Pharynx: It is very thick set with small Glands, the Orifices of which are not so sen-

fible as in the Pharynx, and especially in the Rugæ of the superior Portion thereof, where HEISTER observed a considerable Orifice, and a Duct, proportioned to that Orifice, which he could easily inflate with Air*.

This Membrane, together with that of the posterior Nares, forms, by an uninterrupted Continuation, the anterior and posterior Surface of the soft Portion, or Septum Palati, so that the muscular Fasciculi of this Portion lie in the Duplication of a glandulous Membrane; the Muscles composed of these Fasciculi, as shall be described.

The Septum, which may likewise be termed Vellum, or Valvula Palati, terminates inferiorly by a loose floating Margin, representing an Arch, situated transversely above the Basis or Root of the Tongue: The highest Portion, or Apex of this Arch, sustains a small, soft, and irregularly conical glandulous Body, fixed by its Basis to the Arch, and its Apex hanging down without adhering to any Thing, which is called UVULA.

On each Side of the Uvula there are two muscular Semi-curvatures, called Columnæ Septi Palati: They are all joined to the Uvula by their superior Extremities, and disposed in such a Manner that the inferior Extremities of the two which lie on the same Side are at a little Distance from each other, so as that one Semi-curvature is anterior, the other posterior, an oblong triangular Space being

* This is certainly the best Way of beginning these Kinds of Inquiries, especially if the Pipe be held, at first, only very near the Part, without endeavouring to force it in. To immerge the Parts in clear Water, in the Manner already mentioned, is likewise a very good Way to discover small Orifices, by the Help of a Microscope. Small Ducts, of the same Kind with what have been already mentioned, may be supposed to lie along the middle Line or Raphe of the Curvature of the Palate, and along the alveolar Margin, because of some small Tubercles or Points which appear there.

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left between them, the Apex of which is turned towards the Basis of the Uvula.

The two Semi-curvatures on one Side, by connecting the like Semi-curvatures on the other Side, form the entire Curvature of the Margin of the Septum; the posterior Semi-curvatures run, by their superior Extremities, more directly towards the Uvula than the anterior; the anterior Semi-curvatures have a Continuation with the Sides of the Basis of the Tongue, and the posterior with the Sides of the Pharynx: At the inferior Part of the Space left between the lateral Semi-curvatures, on the same Side, two Glands are situated termed Amygdalæ.

The Semi-curvatures are chiefly composed of several flat muscular Portions, almost in the same Manner with the Body of the Septum; the Membrane which covers them is thinner than the other Parts of it towards the Palate, Pharynx, and Tongue: Each Portion is a distinct Muscle, the greatest Part of which terminate, by one Extremity, in the Substance of the Septum and of the Semi-curvatures; and, by the other Extremity, in Parts different from these.

As Anatomists used formerly to ascribe all these Muscles, as far as they knew them, to the Uvula, without any Regard to the Septum; they termed them, in general, either Ptery-Staphylini, or Peri-Staphylini. The last Part of these two compound Words expresses the Uvula; the first Part of the first Word is an Abridgment of Pterygoïdes, and expresses the Insertion of these Muscles; but the first Part of the second Word signifies no more than round, or about, &c.

We shall make Use of the Term Peri-Staphylinus as a general Denomination for the Muscles belonging to the Septum, and then add the other

Terms of which these Names have been composed, by modern Writers*.

The GLOSSO-STAPHYLINI are two small Muscles fixed in the inferior and lateral Part of the Basis of the Tongue, from whence they ascend, posteriorly oblique, along the anterior Semi-curvature of the Septum Palati; and terminate insensibly, on each Side, near the Uvula; some of their Fibres being spread thro' the Septum. The Thickness of the anterior Semi-curvatures is chiefly owing to these two Muscles.

The PHARYNGO-STAPHYLINI are likewise two small Muscles; each of them being fixed, by one Extremity, to the lateral Part of the Musculi Thyro-Pharyngæi, as if they were Portions detached from these Muscles: From thence they ascend, anteriorly oblique, along the two posterior Semi-curvatures of the Septum, and terminate in the Septum above the Uvula, where they meet, and seem to form an entire Curvature by the Union of their Fibres. The Thickness of the two posterior Semi-curvatures is owing to these Muscles.

The THYRO-STAPHYLINI are two small Muscles which accompany the Pharyngo-Staphylini, very closely, thro' their whole Course, except that their posterior Extremities are fixed in the thyroïd Cartilages, near the other Muscles: They likewise contribute to the Thickness of the posterior Semi-curvatures, and are inserted in the Septum in the

* Left we should be thought to affect a Language different from the common, we shall retain the ordinary Names; and only desire the Reader to take Notice, that, by the Term Staphylini, we do not mean precisely the Uvula, but only the Parts round it. If we could be allowed to frame Names of Greek and Latin Words compounded together, we might, for Example, say, Glosso-Palatinus, instead of Glosso-Staphylinus. We shall call the Muscles, that go to the Uvula, simply Staphyl'ni, or Epistaphylini; because that Part resembles a small Bunch of Grapes, according to the Signification of the Greek Word. WINSLOW.

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same Manner with the former. These two Pairs of Muscles may be made one Pair, and be called Thyro-Pharyngo-Staphylini.

The SPHENO-SALPINGO-STAPHYLINI, or PERI-STAPHYLINI EXTERNI, are fixed, by one Extremity, partly to the sphenoid Side of the osseous Portion of the EUSTACHIAN Tube, and partly to the nearest soft Portion of the same Tube; from thence they run towards the external Ala of the Apophysis Pterygoïdes, into which one Portion of this Muscle is inserted; the other Portion runs to the End of the Ala, and turns round to the forked Extremity thereof as over a Pulley, and is afterwards inserted in the Septum Palati near the Uvula.

These two Portions are looked upon as distinct Muscles; one of which, terminating in the Ala, seems to serve only for the Dilatation of the Tuba EUSTACHIANA; the other Portion is a true Spheno-Staphylinus: And, as it has likewise an Insertion in the Tube, it may be termed Spheno-Salpingo-Staphylinus, or Staphylinus Externus. This is the Muscle commonly called Peri-Staphylinus Externus.

The PTERYGO-STAPHYLINUS SUPERIOR is only the external Portion of the Muscle last described; and this Name may likewise be given it, because it has a small Insertion in the superior Part of the Apophysis Pterygoïdes, besides that in the sphenoid Part of the osseous Portion of the Tube*.

The PETRO-SALPINGO-STAPHYLINI, or SALPINGO-STAPHYLINI INTERNI, are those which

* HEISTER first observed, that the Pterygo-Staphylinus Inferior, on each Side, is a small Muscle, inserted, by one Extremity, in the Uncus Pterygoïdæus; and, by the other, in the Septum, near the Uvula.

are commonly called Peri-Staphylini Interni: Each Muscle is fixed, by one Extremity, partly to the internal Side of the osseous Portion of the EUSTACHIAN Tube, or that next the Apophysis Petroſa; partly along the cartilaginous Portion of the ſame Tube; thence it paſſes a little way under the ſoft membranous Part, and towards what may be called the Half Pad of the Tube; and then, turning towards the Septum, is partly fixed in the Margin, and partly in the ſuperior Side thereof.

The STAPHYLINI, or EPISTAPHYLINI, are two ſmall muscular Ligaments, ſo cloſely connected as if they made but one Muscle; but in ſome Subjects they are diſtinguiſhed by a very fine Linea Alba: They are fixed, by one Extremity, in the common Point of the poſterior Margins of the Oſſa Palati, and thence deſcend poſteriorly along the Middle of the Septum, and likewise along the Middle of almoſt the whole Uvula*.

The SEPTUM PALATI ſerves to conduct the lachrymal Lympha, and that which is continually collected on the Curvature of the Palate, into the Pharynx; it alſo ſerves for a Valve, to hinder what we ſwallow, and eſpecially what we drink, from returning by the Nares. The Uſes of the different Muscles of the Septum are not, as yet, ſufficiently known, nor the different Motions which it is capable of; as may be obſerved, by looking, for ſome Time, into a healthy Perſon's Mouth opened wide.

The PHARYNX is a muscular and glandular Bag, the external Surface of which is cloſely joined to the internal Surface of all that Space which is at

* Theſe Muscles have been termed Azygos MORGAGNI, from the Discoverer; but he conſidered them as one Muscle. The Pterygo-Staphylini Inferiores are of the ſame Kind, and might be termed Staphylini, or Epistaphylini Laterales, and theſe laſt Medii. WINSLOW.

the Bottom of the Mouth, behind the posterior Nares, Uvula, and Larynx, and which reaches from the great or anterior Apophysis of the Os Occipitis all the Way to the Oesophagus, which is the Continuation of the Pharynx: This Space is bounded posteriorly by the Muscles which cover the Bodies of the first cervical Vertebræ, and laterally by the superior Portions of both the internal jugular Veins, and of both the internal carotid Arteries, by the spinal Apophyses of the Os Sphenoides, by the Extremities of the Apophyses Petrosæ, by the Os Sphenoides, immediately above the internal Alæ of the Apophyses Pterygoïdes, and by the adjacent Portion of both pterygoïd Muscles.

From these Limits and Adhesions of the Pharynx we may pretty nearly determine its Figure. It may be compared to the wide Part of a covered Funnel, of which the Oesophagus is the narrow Part, or Tube; or it may be called the broad End of the Oesophagus, that and the Pharynx, taken together, being compared to a Trumpet. The Pharynx may be divided into three Parts: One superior, which is the Curvature of the Pharynx; one middle, which is the Body or great Cavity; and one inferior, which is the Bottom, narrow Portion, or Sphincter. We are likewise to observe three Apertures in it: That of the Curvature, towards the Nares; that of the Body, towards the Mouth; and that of the Bottom, towards the Oesophagus.

The Curvature is the broadest Part of the Pharynx, and ends, on each Side, in an Angle or Point, towards the jugular Fossulæ of the Basis Cranii; afterwards, the great Cavity contracts a little towards the Sides, all its other Dimensions continuing the same; and behind the Larynx it is again enlarged on each Side, a very small Space
being

being left between it and the cricoïd Cartilage. The Extremity of the inferior Portion is very narrow, and joins the Basis of the Cartilage before mentioned.

The Pharynx is formed partly of several distinct musculous Portions, which are looked upon as so many different Muscles, so disposed as to form a large Cavity; and partly of a Membrane which lines the internal Surface of this whole Cavity, and is a Continuation of that of the Nares and Palate.

This Membrane is wholly glandular; and it is thicker on the superior and middle Portions of the Pharynx, than on the Basis or inferior Portion: Immediately above the first Vertebra it forms several longitudinal Rugæ, very thick, deep, and short; and we generally find therein a Collection of Mucus in dead Bodies. In the great Cavity there are no Rugæ, the Membrane adhering, both there and in the superior Part, very closely to the Muscles. At the inferior Part, where it is thinnest, it covers, likewise, the posterior Part of the Larynx, and is very loose, and formed into irregular Folds; it runs in a little, on each Side, between the Margins of the Pharynx.

Tho' almost all the muscular or fleshy Portions, of which the Pharynx is composed, concur in the Formation of one continued Bag, or Receptacle; they are, nevertheless, very distinguishable from each other; not only by their different Insertions, from which they have been denominated, but also by the different Directions of their Fibres: The greatest Part of them may be looked upon as digastric Muscles, the middle Tendons of which lie anteriorly in one longitudinal Line, which, in some Subjects, appears plainly like a Linea Alba.

These Muscles may be reduced to three general Classes, with regard to their Insertions. The first
Class

Class is those which are inserted in the Basis of the Cranium; the second comprehends those which are inserted towards the Mouth; and the third includes those inserted in the lateral Parts of the Larynx.

1. The CEPHALO-PHARYNGÆI are inserted in the inferior Side of the Apophysis Basiliaris, or great Apophysis of the Os Occipitis, about the Middle of the posterior Part; from thence they separate laterally, and sometimes join the Stylo-Pharyngæi: The Linea Alba of the Pharynx begins by the middle Adhesion of these Muscles.

The PETRO-PHARYNGÆI are inserted in the inferior Part of the Extremity of the Apophysis Petrosa; the Spheno-Pharyngæi partly in the Os Sphenoides, directly above the internal Ala of the Apophysis Pterygoïdes, and partly in the adjacent cartilaginous Portion of the EUSTACHIAN Tube; and the Pterygo-Pharyngæi in the Margin of the same Ala of the Apophysis Pterygoïdes: These three Muscles, on each Side, run obliquely backwards, covering each other by some Fibres, and meet at the Linea Alba. Their Use may be, to draw the middle Portion or great Cavity of the Pharynx upwards.

The STYLO-PHARYNGÆI are inserted interiorly, by one Extremity, in the Apophysis or Epiphysis Styloïdes; thence each Muscle runs down obliquely along the lateral Part of the Pharynx, covering and crossing the other Muscles. It extends gradually in Breadth as it descends, and forms two principal Portions; one superior, which is narrow; and one inferior, which is broad: The narrow Portion is spread among the muscular Fibres above the thyroïd Cartilage, and the broad Portion is inserted in the Side of that Cartilage; and thus the Stylo-Pharyngæus is partly a true Stylo-Thyroïdæus. These Muscles may draw the Pharynx laterally

terally upwards, especially by their thyroïd Portions; but the Use commonly assigned to them, of dilating the Pharynx, seems conformable neither to their Situation nor Direction.

2. The PERISTAPHYLO-PHARYNGÆI are two small Muscles inserted between the Uvula and inferior Extremity of the internal Ala of the Apophysis Pterygoïdes, and run obliquely backwards on the Sides of the Pharynx*.

The HYO-PHARYNGÆI, in general, are those, on each Side, which are inserted in the Os Hyoïdes; and they may be reckoned three Pairs; the Basio-Pharyngæi, Kerato-Pharyngæi Minores, and Kerato-Pharyngæi Majores; these Denominations being taken from their Insertions in the Basis, and in the small and great Cornua of the Os Hyoïdes†.

The THYRO-PHARYNGÆI are very broad, and each Muscle is inserted along the external Side of the Ala of the Cartilago Thyroïdes, between the Margin of that Cartilage and the oblique Line in

* It is difficult to find them in very lean or young Subjects; and they seem to be the same which SANTORINI calls Hypero-Pharyngæi, or Palato-Pharyngæi. The Glosso-Pharyngæi are Fibres which run along the lateral Margins of the Tongue, from which they are separated posteriorly, and descend on the Sides of the Pharynx under the Stylo-Pharyngæi.

† WINSLOW observes, that he never has been able to see distinctly the Mylo-Pharyngæi of JAMES DOUGLAS: All that he has hitherto found is, a muscular Portion really distinct from the Genio-Glossus, inserted in the Side of the Pharynx; and, for that Reason, he calls it Genio-Pharyngæus, as being joined to the Genio-Glossus all the way to the Chin, which indeed is nothing.

The SYNDESMO-PHARYNGÆI of DOUGLAS are Fasciculi of muscular Fibres very distinctly inserted, by one End, along the Ligaments by which the superior Cornua of the Cartilago Thyroïdes are connected to the Extremities of the great Cornua of the Os Hyoïdes; from thence they run posteriorly, and meet at the Linea Alba. To be able to see them distinct from the other Muscles, the Pharynx must be filled with Cotton, to give it a proper Convexity, and to support its Sides, which otherwise collapse and sink inwards, and thus prevent our seeing the Direction and Distinction of several of the Muscles belonging to it.

which

which the Thyro-Hyoïdæi are fixed ; and they are a little confounded with the Crico-Hyoïdæi : From thence they ascend obliquely backwards, and, meeting under the Linea Alba, sometimes appear to be but one Muscle, without any middle Tendon. Sometimes they have appeared to be distinguished into superior and inferior, because their superior Portion ascends posteriorly, and their inferior Portion more transversely.

The CRICO-PHARYNGÆI are each inserted in the inferior Part of the Side of the cricoïd Cartilage : They seem to be Appendices of the Thyro-Pharyngæi ; shewing no other Marks of Distinction but these Insertions, and a small Difference in Direction ; because, as they run posteriorly, they descend a little. For this Reason, WINSLOW has sometimes looked upon these two Muscles as one ; and called it Thyro-Crico-Pharyngæus.

The inferior of these muscular Fibres make a complete Circle, posteriorly, between the two Sides of the Pads of the Cartilago Cricoïdes : This Circle is the Beginning of the Oesophagus ; and has been thought, by some, to form a distinct Muscle called Oesophagæus*.

The particular Uses of all these Muscles are very difficult to be determined. It is certain that those of the middle and inferior Portions of the Pharynx serve, chiefly, for Deglutition : Those of the superior Parts, and some of those of the middle, may, among other Functions, be useful in modifying the Voice, according to the Opinion of SANTORINI.

* WINSLOW has found another Fasciculus of Fibres detached from the Thyro-Pharyngæus, and inserted laterally in the thyroïd Gland ; for which Reason he calls it Musculus Thyro-Adenoïdæus.

OBSERVATIONS.

Tho' the Use of the Uvula is not sufficiently known, yet it is very probable, that it assists in modulating the Voice (it is wanting in all Quadrupedes). Sometimes the Uvula is destroyed by means of the Lues Venerea, &c. then, generally, the Voice is much impaired, and Deglutition is improper.

The Uvula sometimes tumifies to a considerable Volume, which lengthens it vastly; inso-much, that I have seen Patients who could hardly breathe. In such a Case, if proper Care be not taken immediately, the Disease may prove of very bad Consequence; that is, to mortify not only itself, but also the adjacent Parts; viz. the Aspera Trachea, Oesophagus, Tongue, and the Glands which lie in the Vicinity of the Part; which I had an Opportunity of being convinced of, in a female Subject that I dissected.

In some Cases, we are obliged to ampute the Uvula: Therefore, when there is Reason to suspect that it is gangrened, in such a Case, the sooner the Operation is performed, the better; as being a means of preventing its spreading or infecting the other Parts of the Mouth, &c.

I have seen Children who had neither Uvulæ nor Palates.

Mr. WARNER opened the Body of a young Woman, who died of the Disease commonly called a sore Throat, and found her Oesophagus about an Inch thick beneath the cricoïd Cartilage; and, when opened longitudinally, it appeared so contracted, in the morbid Part, as hardly to admit of a common Probe. The Oesophagus was ulcerated internally. See his Observations, or Cases in Surgery.

Those

Those who are desirous to inform themselves of the Nature of sore Throats, attended with Ulcers, may read the Account wrote by that judicious Physician Dr. FOTHERGILL ; who, in the Scarcity of his Times, has favoured the World with a summary View of those Authors who first took Notice of this Disorder ; besides what has happened in the Sphere of his great and extensive Practice : Wherein he gives an exact Account of the Symptoms attending this Disease, which raged, a few Years ago, in London and the adjacent Places ; with the Method to cure it. -- This Treatise has been translated into several Languages already, yet it is only a Pamphlet ; and has gone thro' divers Editions in English.





LECTURE II.

Of the TONGUE.



VERY one knows, that the TONGUE is a soft muscular Body, which fills all that Part of the Cavity of the Mouth that is surrounded by the alveolar Border and Teeth of the inferior Maxilla, and extends still farther posteriorly. All this Space is therefore, in a Manner, the Mould and Measure of the Length and Breadth of the Tongue, as well as of its Thickness and Figure.

The Tongue is divided into the Basis and Apex, the superior and inferior Surfaces, and the lateral Portions or Margins. The Basis is the posterior and thickest Part; the Apex the anterior and thinnest Part: The superior Surface is not quite flat, but a little convex, and divided into two Semi-laterals, by a shallow depressed Line called *Linea Lingua Mediana*. The Margins are thinner than the other Parts, and a little rounded, as well as the Apex. The inferior Surface reaches only from the Middle of the Length of the Tongue to the Apex.

It is principally composed of very soft muscular Fibres, intermixed with a particular medullary Substance, and disposed in various Manners.

Many of these Fibres are confined to the Tongue, without going any farther; the rest form separate Muscles, which emerge from it different Ways, and are inserted in other Parts. All the

superior Surface of it is covered by a thick Membrane of a papillary Texture, upon which lies another very fine Membrane, like a kind of Epidermis, which is likewise continued over the inferior Side, but without Papillæ.

Three Sorts of Papillæ may be distinguished in the superior Surface of the Tongue; *CAPITATÆ*, *SEMI-LENTICULARES*, and *VILLOSÆ*. Those of the first Kind are the largest, resembling little Mushrooms with short Stems, or Buttons without a Neck: They lie on the Basis of the Tongue in small superficial Fossulæ, and resemble small conglomerate Glands, seated on a very narrow Basis, and each of them has sometimes a small Depression in the Middle of their superior or convex Side: They occupy the whole Surface of the Basis of the Tongue, and are situated near each other in such a Manner, that the most anterior form an Angle. They are glandular Papillæ, or small salival or mucilaginous Glands, as shall be described.

We oftentimes observe, about the Middle of this Part of the Tongue, a particular Foramen, of different Depths, the interior Surface of which is entirely glandular, and filled with small Papillæ, like those of the first Kind. It is called *FORAMEN CÆCUM MORGAGNII*, as being first described by that Author: Since that Time, *VATERUS* has discovered a kind of salival Ducts belonging to it; and *HEISTER* saw two of these Ducts very distinctly, the Orifices of which were in the Basis of the Foramen Cæcum, near each other. He observed the Ducts to run posteriorly, divaricating a little from each other; and that one of them terminated in a small oblong Vesicle situated on the Side of the small Cornu of the *Os Hyoides*.

The Papillæ of the second Kind, or *Semi-Lenticulares*, are small orbicular Eminences, only a

little convex, their circular Margin not being separate from the Surface of the Tongue. When we examine them, in a sound Tongue, with a good Microscope, we find their convex Sides full of small Foramina, or Pores, like the End of a Thimble.

They lie chiefly in the middle and anterior Portions of the Tongue, and are sometimes most visible on the Margins, where they appear to be very smooth and polished, even to the naked Eye, and sometimes in living Subjects. They soon lose their Consistence after Death; so that, by rubbing them several Times, they may be drawn out in Form of small soft Pyramids, inclined to one Side.

The Papillæ of the third Kind, or Villoſæ, are the smallest, and most numerous: They fill the whole superior Surface of the Tongue, and even the Interstices between the other Papillæ. They would be more properly named Papillæ Conicæ, than Villoſæ, from the Figure which they appear to have, when examined through a Microscope in clear Water.

They are naturally softish, but become extremely flaccid after Death; so that, by handling them, they may be made short and thick; whereas they are naturally long and small.

The muscular Fibres of which the Tongue is composed, and which go no farther than it, may be termed MUSCULI LINGUÆ INTERIORES, or the INTRINSIC MUSCLES; and they are the same which SPICELLIUS named MUSCULI LINGUALES.

The Fibres these Muscles consist of, are of three general Kinds; longitudinal, transverse, and vertical; and each of these Situations admits of different Degrees of Obliquity.

The longitudinal Fibres point to the Basis and Apex of the Tongue, and seem, partly, to be Expan-

sions

panfions of the Musculi, Stylo-Glossi, Hyo-Glossi, and Genio-Glossi.

The vertical Fibres seem likewise to be, in part, produced by the same Genio-Glossi, and the transverse by the Mylo-Glossi.

Besides these mixed Productions, there is a distinct Lamella of longitudinal Fibres, which run near the Surface of the superior Side of the Tongue, and a distinct transverse Lamella under them.

These Fibres * are partly interwoven; one Portion of them terminating at the two Margins of the Tongue, and the other at the Basis and Apex, without going to any other Part; and they lie immediately above those that belong to the Genio-Glossi.

The extrinsic Muscles, or Musculi Exteriores, are those which, by one Extremity, make a Part of the Body of the Tongue; and are fixed, by the other, in some Part without the Tongue. Of these, we commonly reckon four Pairs; viz. MYLO-GLOSSI, STYLO-GLOSSI, HYO-GLOSSI, and GENIO-GLOSSI.

The Muscles which move the Os Hyoïdes likewise belong to the Tongue, and are the principal Directors of its Motions. The Names of these are as follow; viz. MYLO-GENIO-STYLO-OMO and STERNO-HYOÏDÆI.

The MYLO-GLOSSI are small muscular Lamellæ situated transversely, one on each Side, between the Ramus of the inferior Maxilla and the Basis of the Tongue. Their Insertions in the Maxilla are immediately above the posterior Half of the Mylo-Hyoïdæus, between the prominent oblique Line,

* To discover all these Fibres, and their different Degrees of Direction, we need only cut the Tongue longitudinally, after it has been boiled, or long macerated in strong Vinegar.

on the internal Side of the Bone, and the Dentes Molares; from thence they run towards the Basis of the Tongue, and are lost there on one Side of the Glosso-Pharyngæi. These Muscles are often wanting.

The *STYLO-GLOSSI* are two long small Muscles which descend from the styloid Apophyses or Epiphyses, and form two Portions of the lateral Parts of the Tongue: Each Muscle is fixed, in the external Side of the Apophysis Styloïdes, by a long Tendon, being the most superior of the three Muscles fixed in that Apophysis.

The *STYLO-HYOÏDÆUS* is the lowest, and the *STYLO-PHARYNGÆUS* is in the Middle, but more posteriorly.

As it descends almost opposite to the internal Side of the Angle of the inferior Maxilla, it sends off a pretty broad and short lateral aponeurotic Ligament, which, being fixed in that Angle, serves for a Frænum, or Ligamentum Suspenforium, to the Muscle, in this Part of its Course: From thence it passes on to the Side of the Basis of the Tongue, where it first adheres closely to the lateral Portion of the Hyo-Glossus, and then forms, together with that Muscle, a large Portion of the Side of the Tongue.

The *HYO-GLOSSI* are inserted in three Parts of the Os Hyoïdes that lie near each other; viz. in the Basis, the Root of the great Cornu, and in the Symphysis, between these two: And, on this Account, the Hyo-Glossus has been divided, by some, into two or three distinct Muscles, called *BASIO-GLOSSUS*, *CERATO-GLOSSUS*, and *CHONDRO-GLOSSUS*.

In some Subjects they may easily be separated, the three Portions being simply contiguous to each other; but it is needless to burden the Memory with

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with so many useless Names; therefore we shall describe them all as one Muscle, by the Name of Hyo-Glossus.

It is situated on the internal Side, and a little more inferiorly than the Stylo-Glossus, with which it forms the lateral Part of the Tongue. The Portion inserted in the Basis of the Os Hyoides lies more anteriorly, and is larger than the other two; that which is inserted in the Symphysis is the least, and that inserted in the great Cornu the most posterior.

This Muscle is partly sustained by the Mylo-Hyoidæus, as by a Girth; and the anterior Portion is distinguished from the rest by the Passage of the Nerves of the fifth Pair, and of the Arteries that accompany them.

The GENIO-GLOSSI are situated close to each other on the inferior Side of the Tongue: Each Muscle is inserted in the internal or posterior Side of the Symphysis of the inferior Maxilla, immediately above the Genio-Hyoidæus; from thence it runs posteriorly towards the Os Hyoides, to which the most inferior Fibres are connected by a ligamentary Membrane; and in this Course its Fibres are spread through the Substance of the Tongue in a very singular Manner.

Of these Fibres, some run directly towards the Os Hyoides, all the way to the Basis of the Tongue; some are inflected anteriorly, and go to the Apex; and the rest are distributed, in a radiated Manner, anteriorly, superiorly, and posteriorly, in the Substance of the Tongue; and the middle Fibres expand laterally towards the Margins.

The two Genio-Glossi run so close to each other as if they formed but one Mass, but they are evidently divided by a very thin cellular Membrane, or middle Septum, which penetrates a good way

between the two lateral, or right and left Halves of the Tongue, lying in the same Plane with the Linea Mediana of the superior Side.

When we separate these two Muscles from the Chin, they presently contract so much, that their anterior Extremities, which lay under the Apex of the Tongue, are as far backwards as the Middle of it. It is in this preternatural Situation that we see these Muscles represented in Figures given by very great Anatomists, drawn and engraved by very good Artists, in which the whole Beauty of their true Mechanism is lost.

These two Muscles, by their posterior strait Fibres, which go to the Basis, can draw the Tongue out of the Mouth, and bring it back again, by their anterior crooked Fibres, which go to the Apex. They can, either successively, or all at once, make the Tongue longitudinally concave, or like a Groove; and they can, at the same Time, contract it, by the lateral Expansion of their middle Fibres. We shall pass over many other Motions that these Muscles are capable of performing, which used to be called *Musculi Polychrestii*.

When either of the *Stylo-Glossi* acts, it turns the Tongue towards the Cheek, and forces the Aliment between the superior and inferior Molares; when they act jointly with the lateral Portions of the superior muscular Lamella of the Tongue, they turn it superiorly oblique to the Teeth of the superior Maxilla, and near the Cheeks; as when we bring down any Part of the Food that may have stuck there after Mastication. When they act conjunctly with the lateral Portions of the *Hyo-Glossi*, they turn the Tongue downwards between the inferior Teeth and the Cheek. When all the Parts of the *Hyo-Glossi* act together, they shorten the Tongue: They likewise turn the Apex of it between the Teeth and inferior Lip, and make it
pass

pass over that Lip. The superior muscular Lamella of the Body of the Tongue bends it superiorly towards the Palate, and makes it pass along or lick the superior Lip.

The Mylo-Glossi serve as a Frænum to one Side of the Basis of the Tongue, while the Apex is turned to the other Side. The Ligamenta Suspensoria of the Stylo-Glossi may answer the same Purpose, and even supply the Absence of the Mylo-Glossi.

Besides the Membranes of the Tongue already described, it is customary to mention another, called MEMBRANA RETICULARIS, which is commonly demonstrated from the boiled Tongues of Oxen or Sheep; and some pretend to have shewn it in the human Tongue, which is very much to be doubted. It has been shewed, that what is taken from the Tongues of Oxen and Sheep is not a true Membrane, but a kind of transparent mucilaginous Substance that lies between the papillary and external Membranes, and which, by boiling, becomes white, and acquires Solidity enough to be taken out in large Portions; and that the Foraminæ found in it are owing to the small pyramidal Papillæ.

The Tongue is fixed in the Mouth not only by Muscles, but also by Ligaments, which are, for the most part, membranous. The principal Ligament is that called Frænum, which is the prominent Fold that appears first under the Tongue when we raise it with the Mouth opened; and it is no more than a Continuation or loose Duplication of that Membrane which covers the inferior Cavity of the Mouth. It covers the Curvature of the anterior Portion of the Genio-Glossi from the Apex of the Tongue almost as high as the middle Interstice, between the inferior Dentes Incisorii.

The other Ligaments of the Tongue are the small membranous Fold which runs along the Middle of the convex Side of the Epiglottis to the Basis of the Tongue, and the membranous Folds which cover the inferior Semi-curvatures of the Septum Palati. These three Folds are Continuations of the Membrane that covers the adjacent Parts.

The aponeurotic Ligaments of the Stylo-Glossus may be looked upon as true lateral Ligaments of the Tongue, and adhere a little to the inferior Part of the Musculus Pterygoideus Internus or Anterior.

The principal sanguineous Vessels of the Tongue are those that appear so plainly on its inferior Surface, on each Side of the Frænum; and they consist of one Artery and one Vein, which accompany each other, and are called ARTERIÆ, and VENÆ SUBLINGUALES, or RANINÆ. The Veins lie next to the Frænum, and the Arteries on the other Side of the Veins.

As these Vessels accompany each other, we ought to be aware of Bleeding in this Part, for fear of wounding the Artery, its Aperture producing an Hæmorrhage, which is difficult to be stopped, and has proved fatal.

We observe four Nerves to go very distinctly to the Basis of the Tongue, and to continue their Course through its whole Substance, all the Way to the Apex. Two of these Nerves are Rami of the inferior maxillary Nerves, or of the third Branch of the fifth Pair from the Medulla Oblongata; the other two are the Nerves of the ninth Pair. The two first have been named Linguales, or Hypo-Glossi Majores. The Majores are inferior and internal, the Minores superior and external or lateral. The small Portion or first Branch of the Nervus Sympatheticus Medius,

dus; or of the eighth Pair, sends likewise a Nerve to each Side of the Tongue.

The great lingual Nerve runs anteriorly on each Side, between the Musculus Mylo-Hyoidæus and Hyo-Glossus under the Genio-Glossus, and is distributed to the muscular Fibres all the way to the Apex of the Tongue, communicating, by several small Filaments, with the Lingualis Minor and the Nerve from the eighth Pair. For the other Distributions of it, I refer to the Description of the Nerves.

The small lingual Nerve, on each Side, goes off, from the Maxillaris Inferior, sometimes at, and sometimes before, its Passage between the pterygoid Muscles; afterwards, separating more and more from the Trunk, it passes under the lateral Part of the Tongue over the sublingual Gland. It supplies the nearest Parts of the Tongue as it passes, and then, entering its Substance, terminates at the Apex, having sent a great Number of Filaments to the papillary Membrane: It communicates, as has been said, with the Lingualis Major and the Nerve from the eighth Pair.

This lingual Nerve, a little after it leaves the Maxillaris Inferior, is accompanied by a small distinct Nerve, that ascends posteriorly towards the Articulation of the inferior Maxilla, in Company with the lateral Muscle of the Malleus, passes thro' the Tympanum, between the Handle of the Malleus and the long Leg of the Incus, by the Name of Chorda Tympani; and afterwards, perforating the posterior Side of the Tympanum, unites with the Portio Dura of the auditory Nerve.

This small Ramification has been looked upon, by some Anatomists, as a kind of small Recurrent of the Nervus Lingualis: But as, in some Subjects, it appears to make simply an acute Angle with the lingual Nerve; and as this lingual Nerve

Nerve is somewhat larger after this Angle, it ought rather to be believed to come from the Tympanum; and to unite with the lingual Nerve, than to arise from this Nerve, and ascend to the Tympanum. In some Subjects the Union of this Nerve with the Lingualis, is, in a Manner, plexiform, and very difficult to be unfolded.

The lingual Nerve of the eighth Pair, which is its first Branch, passes first on the internal Surface of the digastric Muscle of the inferior Maxilla, and supplies the Genio-Aryoïdæi, the adjacent Muscles of the Basis of the Tongue, and those of the Pharynx; afterwards it sends out Ramifications, and forms Communications; and, lastly, goes to the inferior Part of the Tongue, where it communicates with the lingual Ramus of the fifth Pair and that of the ninth.

MUSCLES WHICH MOVE THE OS HYOIDES *.

MYLO-HYOÏDÆUS is a broad, thin, peniform Muscle, situated transversely between the internal lateral Parts of the Basis of the inferior Maxilla, and lying on the anterior Portions of the two digastric Muscles.

It is composed of two equal muscular Portions, one lying on the right Side, the other on the left, both in the same Plane, and connected to a small middle Tendon that is inserted anteriorly in the Middle of the Basis of the Os Hyoides; thence it runs directly anteriorly, diminishing gradually in its Course: This is therefore a true digastric Muscle, and cannot be divided.

Each Portion is fixed, by muscular Fibres, to the internal lateral Part of the inferior Maxilla,

* These Muscles are nine in Number; one anterior, without a Fellow; and eight lateral, disposed in four Pairs.

between the oblique prominent Line and the Basis, under the first four Dentes Molares and Caninus; the anterior and greatest Part of the other Fibres, of each Portion, runs obliquely from the anterior to the posterior Part of the middle Tendon, in which they are regularly fixed; the anterior Fibres being the shortest, and a small triangular void Space being formed between them and the Symphysis of the Chin.

The posterior Fibres of each Portion, which make about a fourth Part of the Whole, run likewise, on each Side, to the Basis of the Os Hyoïdes, and are inserted along the inferior Margin of its anterior or convex Side, and thence a little superiorly.

GENIO-HYOÏDÆUS is a small and pretty long Muscle; situated between the Symphysis of the Chin and the Os Hyoïdes, close by its Fellow.

It is fixed, by its anterior Extremity, to a rough, and sometimes prominent Surface on the internal or posterior Side of the Symphysis of the inferior Maxilla, a little above the Chin; thence it ascends posteriorly, and is inserted anteriorly in the superior Margin of the Basis of the Os Hyoïdes, having first sent off a small lateral Portion that is fixed, a little higher, to the Radix of the Cornu.

This Portion is distinguished from the rest by a Nerve of the ninth Pair, and it makes the Muscle appear a little oblique; the two Genio-Hyoïdæi lie very close together, except at their superior Margin, where they are a little separated, but every where else look as if they were but one Muscle.

STYLO-HYOÏDÆUS is a small Muscle lying obliquely between the Apophysis Styloïdes and Os Hyoïdes.

It is fixed laterally, by one Extremity, to the Root of the Basis of the Apophysis Styloïdes; and,

and, by the other, to the Os Hyoïdes, at the Place where the Basis and Cornu unite, and likewise to the Cornu itself; from whence it has been called Stylo-Cerato Hyoïdæus.

The muscular Fibres of this Extremity are often parted, and inclose the middle Tendon of the Digastricus.

OMOPLATO-HYOÏDÆUS, or OMO-HYOÏDÆUS, commonly called CORACO-HYOÏDÆUS, is a very long small Muscle, much narrower than the Sterno-Hyoïdæus, and situated obliquely on the Surface of the Cervix or Throat between the Scapula and Os Hyoïdes. It is a digastric Muscle, being divided into two muscular Portions joined endwise to a short middle Tendon.

It is commonly fixed, by the inferior Extremity, to the superior Costa of the Scapula, between the small Scissure and the Angle, and sometimes very near the Angle; and hence some Anatomists have given it the barbarous Name of Casto Hyoïdæus: From thence it passes over the coracoid Apophysis, adhering sometimes to it by a kind of Aponeurosis or membranous Ligament, and from this Adhesion the Name of Coraco-Hyoïdæus was given it by some who had not discovered its main Insertion.

It is likewise often fixed to the Clavicula by ligamentary or muscular Fibres, and sometimes it is inserted in the whole middle Portion of that Bone, being inseparably united with the Sterno-Hyoïdæus*. Having passed the Clavicula, it is bent anteriorly, and runs between the Sterno-Mastoïdæus and internal jugular Vein, the small middle Tendon being situated in this Place: From thence

* In one Subject I found it to be a kind of Biceps, one Portion of it being fixed to the Angle of the Scapula, the other to the Extremity of the Clavicula. WINSLOW.

it ascends to its Insertion in the inferior lateral Part of the Basis of the Os Hyoides; near the Cornu and Insertion of the Sterno-Hyoides, which it covers a little.

STERNO-HYOÏDÆUS, or STERNO-CLEÏDO-HYOÏDÆUS, is a long, thin, flat Muscle, broader at the inferior than the superior Part, and situated, together with its Fellow, on the anterior Side of the Throat; whence some have very improperly termed it *Musculus Bronchialis*.

It is fixed, by its inferior Extremity, in the superior and lateral Part of the internal or posterior Side of the Sternum in the posterior Part of the sternal Extremity of the Clavicula in the transverse Ligament that connects these two Bones, and in the internal or posterior Side of the Cartilage of the first Rib. All these other Insertions are more considerable than that in the Sternum, which is sometimes scarce perceptible. From thence it ascends on the anterior Side of the *Astera Arteria*, connected to its Fellow by a Membrane that forms a sort of *Linea Alba*, and is inserted laterally in the inferior Margin of the Os Hyoides.

There is sometimes a transverse tendinous Line about the Middle of the posterior Side of this Muscle.

USES OF THE MUSCLES WHICH MOVE THE Os Hyoides. The Mechanism of the Motions of the Os Hyoides, as well as that of the Scapula, is very particular, and different from what we find of all the other Bones of the human Body. All these Bones have solid Fulcra, on which they are either moved, or kept fixed, by the proper Muscles, after the Manner of a Lever, or otherwise; whereas the Os Hyoides is merely suspended, having nothing to fix it but these very Muscles, that move it in different Manners.

The

The Mylo-Hyoïdæus represents a moveable Floor, or Bed, which sustains the Tongue, with its Muscles and Glands, and forms the Basis of the Cavity of the Mouth. When the two Portions of this Muscle act together, they draw the Os Hyoïdes a little anteriorly, and fix it in that Situation, raising the whole Tongue at the same Time, and compressing the Glandulæ sublinguales. If one lateral Portion acts more than the other, it puts the Os Hyoïdes in an oblique Situation, and in a Condition to serve as a fixed Point for the Motions of the Tongue.

The Genio-Hyoïdæi pull the Os Hyoïdes much more anteriorly than the Mylo-Hyoïdæus; and, as they are very narrow, and closely connected, there seems to be very little Occasion for one of them to act without the other.

The Stylo-Hyoïdæi move the Os Hyoïdes superiorly and posteriorly, in a middle Direction between those in which they lie; and draw it more superiorly and posteriorly when they act freely, that is, without being checked or confined by other Muscles, as shall be shewn. When one acts more than another, the Bone is moved obliquely.

The Omo-Hyoïdæi, or Coraco-Hyoïdæi, act, as the Stylo-Hyoïdæi, in a middle Direction between the oblique Directions, in which they lie, and draw the Os Hyoïdes inferiorly and posteriorly, when they are not counter-balanced by the Stylo-Hyoïdæi. When one acts more than the other, the Bone is drawn obliquely to the right or left Hand: When these Muscles and the Stylo-Hyoïdæi act together, the Os Hyoïdes is drawn posteriorly by a direct Motion compounded of four oblique Motions. This compound Motion is directed more superiorly, or laterally, according to the Degree of Action of the Stylo-Hyoïdæi, or Omo-Hyoïdæi, or any one Muscle of each Pair; and

and, in all these Motions, the four Muscles are counter-balanced by the Genio-Hyoïdæi.

The Length and Direction of these two thin Muscles, as well as their Insertion in the Scapula, deserve our Attention. It seems evident, that, for the Uses already mentioned, they could not have been inserted any-where else; and therefore that they are fixed, in the Scapula, by a mechanical Necessity; and must, consequently, be very long. Their incurvated Direction and Situation, behind the Sterno-Mastoïdæi, enables them to perform their several Motions in all the different Postures of the Head, the lateral Motions not excepted: For when the Head is turned to either Side, the Sterno-Mastoïdæus, of the same Side, does the Office of a Pulley to the Omo-Hyoïdæus behind it.

The Sterno-Hyoïdæi draw the Os Hyoïdes inferiorly direct, and serve to counter-balance the different Motions of the Stylo-Hyoïdæi, Omo-Hyoïdæi, and Genio-Hyoïdæi; and may, in some Cases, be assisted by the Sterno-Thyroïdæi and Thyro-Hyoïdæi, as shall be shewn.

The Tongue is the Organ of that Sense called Taste, by means of the Papillæ, especially the Villose, or Pyramidales. It is not, as yet, discovered, in what Manner the Papillæ Semi-lenticulares contribute to the Taste; and the Capitatae ought to be looked upon as salival Glands.

This Organ is likewise one of the principal Instruments of Speech, and of the Articulation of the Voice*.

The

* RIOLAN, in his *Anthropographia*, mentions a Child, of Five Years of Age, who, tho' he had lost his Tongue by the Small Pox, but not the Uvula, continued still to speak, almost as distinctly as before. Probably the Basis of the Tongue still remained.

The TASTE is a Sensation excited by the Relish of the different Aliments we use. The saline Parts of Aliments are thought to be the principal Cause of Taste; and it is also believed, that the Corpuscles which form these saline Parts, being attenuated by the Saliva, and afterwards applied to the Organ of Taste, insinuate themselves into and move it, according to the Relation they have to it. In this Organ we ought to comprehend the Papillæ of the Tongue, and especially those of the third Kind, which are the smallest, and which are found on the Apex of the Tongue, and which, afterwards, spread over its Extent. It is evident, that it is on the saline Parts of Aliments that their Taste depends; because we observe, that there are no savoury Bodies from which we cannot extract Salt, and which do not become insipid as soon as this Salt is obtained, in the same Manner as there is no insipid Substance that may not become savoury by having Salt mixed with it.

Besides, we observe, that nothing becomes capable of being tasted that is not moist; because it is necessary that the Particles of the Salts should be sufficiently attenuated, to penetrate to the immediate Organ, and there excite an Agitation sufficient to excite this Sensation.

I shall not here consider the different Kinds of Tastes, but only observe, that what seems to produce a Difference in the Tastes of several Persons, arises principally from the Nature of their Saliva, which is more proper in some, than in others, to dissolve the Particles of savoury Bodies; and the

Monseigneur DE JUSSIEU has published an Observation, in the Memoirs of the Royal Academy of Sciences at Paris, concerning a little Girl, who could speak, tho' she was born without a Tongue; instead of which, there was only a small Tubercle.

Change

Change of Taste, that happens in the same Person, appears to be the Effect of some Alteration in the Saliva.

Tho' the Tongue be the principal Organ of Taste, and is subservient to Mastication, Deglutition, and Pronunciation; yet these Functions may be performed without the Assistance of this Organ; which is proved, by an Observation inserted in the German Journals: Where it is said*, that a Child, about Eight or Nine Years of Age; in the Small Pox lost his Tongue, spitting it up gradually, till no Portion of it remained; yet spoke, spit, chewed, and swallowed his Aliments: He had also the Sense of Taste; distinguishing different Savours: But before this Observation appeared, MALPIGHI, and several other Anatomists, imagined, that the Palate was not subservient to Taste; founding their Opinion on the Discovery they had made of the nervous Papillæ there.

We may think that the Palate is also somewhat subservient to the Taste, by applying some favourable Substance to it; for we shall not fail to discover the Savour of them in Proportion as their Parts are sufficiently expanded to make any Impression upon it.

Only the superior and lateral Margins of the Tongue are fitted to exercise the Sense of Taste; but by the Tongue we understand a muscular Body, broad and fulcated in Man, and lodged in the Mouth, whose posterior and inferior Parts are variously connected to the adjacent Bones and Cartilages, while it remains moveable on its anterior

* We have, besides this, a remarkable Instance in the Memoirs of the Royal Academy of Sciences at Paris for the Year 1718; and, in the Philosophical Transactions, an Account of one MARGARET CATING; who spoke without a Tongue, ingeniously explained by Dr. PARSONS.

and superior Part. In those Portions of the Tongue which make the Organ of Taste, the Skin grows to the adjacent muscular Fibres, being continued from the Skin of the Face and Mouth; only here it is always soft and pulpy, from the perpetual Warmth and Moisture. From this Skin of the Tongue arise innumerable Papillæ, of a more considerable Bulk here than in other Parts. Of these there are several Kinds: The first of them are disposed in a Rank on the posterior Part of the Tongue, on each Side the Foramen Cæcum: These, surrounding that Aperture like a Circle, are, for the most part, conical, having a deep Sinus in their Center, but are otherwise hard, and but indifferently disposed for tasting. There are some other Papillæ found scattered before these posteriorly on the Tongue.

The other Kind of Papillæ are like Mushrooms, less and slenderer than the former, of a cylindrical and somewhat oval Figure, placed at some small Distances from each other upon the superior Surface of the Tongue, where they grow sharper pointed, as they lie more anteriorly, and are most numerous on the Sides of the Tongue.

The third Sort of Papillæ, which abound most in Number, are spread largely over the Tongue, between the former, with their Apices somewhat inclined, and fluctuating anteriorly, towards the Apex; and these, which are likewise most numerous on the Sides of the Tongue, are extremely sensible, and make the true Organ of Taste.

As for the intermediate arterial and venal Pile, or Villi, which serve for exhaling and inhaling thin Juices; they have nothing in common with the Taste itself, unless that, by separating and pouring out a thin Juice from the Blood upon the posterior Surface of the Tongue, they conduce to soften the

the Papillæ, and dissolve the saline or sapid Particles*.

These Papillæ have, doubtless, small Nerves detached into them, besides numerous Vessels, tho' they are difficult to trace: For we observe, that larger Nerves go to the Tongue, than almost in any Instance that we have in other Parts. For, besides the Nerve of the eighth Pair, which, being one of the principal of the three Branches, enters the Basis of the Tongue, deeply covered by the Cerato-Glossus near the Os Hyoides; there is also a considerable Nerve that goes to the Tongue, and its Muscles from the ninth Pair, which, having inosculated with the first cervical Nerve, and with the large cervical Garglion, sends a Branch inferiorly, and frequently joins the eighth Pair, but constantly communicates with the second and third cervical Pairs; from whence its Branches ascend to the Muscles arising from the Sternum, and frequently communicate with the phrenic Nerve; after which, the rest of its Trunk goes to the Tongue. This communicates, by many Branches, with the fifth Pair in the Cerato-Glossus, and is, more especially, spent in the Genio-Glossus.

Lastly, The third Branch of the fifth Pair, having sent up or received the Ramus of the Tympanum, and given other Branches to the internal Pterygoïdes, with the maxillary and sublingual Glands, passes, with its principal Trunk, behind the Cerato-Glossus, where it connects the ninth Pair, and enters the Tongue deeply, together with the Artery, with which it is extended

* In the superior and posterior Part of the Tongue are seated many circular, simple, muciferous Glandules, furnished each with one or more Outlets completed either by an hemispherical Membrane, or by the Flesh of the Tongue: Some of these open into an obscure Foramen, or rather Antrum Cæcum, of an uncertain Figure, and seated in the midst of the largest Nipples.

to the Apex, where it becomes cutaneous. To this Nerve, therefore, if there be any Prerogative or Preference, the Sensé of Taste is to be more especially ascribed.

We observe the Nipples or Papillæ of the Tongue are of a hard Texture, each Papilla having its pulpy Fabric formed by a Number of small Nerves, Arteries, and Veins, conjoined or wound up together like a Button or Protuberance, by a firm cellular Substance.

Over the Papillæ of the human Tongue is spread only a single mucous and semi-pellucid Covering, which adheres to them, and serves as a Cuticle: But, in brute Animals, a perforated mucous Reticula receives the Papillæ, which are, in a Manner, contained in Capsulæ of this mucous Substance, covered with the Cuticle.

Under those Papillæ are spread the Muscles that make the fleshy Substance of the Tongue, which are very numerous, and hardly extricable in the human Tongue: In the inferior Part it is, in a great measure, formed of the Genio-Glossus Muscle, extended externally from the meeting of the Chin, and distributed, like so many Radii, in the very Substance of the Tongue. The superior and lateral Parts are formed by the Stylo-Glossus, whose Fibres run to the Apex of the Tongue, which in its middle Part, between the former Muscles, is composed of one proper to itself, called Lingualis; which, arising anteriorly of the Pharynx and Origin of the Stylo-Glossus, only more inferior, egresses anteriorly, and, terminating between the Genio-Glossus and Stylo-Glossus, forms a very considerable Part of the Tongue.

The posterior Part of the Tongue is composed of the Fibres of the Cerato-Glossus, which ascend posteriorly, and by the Fibres of the Cerato-Glossus, a Muscle distinct from the former, which
arises

arises from the small Bones and adjacent Basis of the Os Hyoides; from whence passing externally with its lateral Portion, covered by the Genio-Glossus, it joins the Stylo-Glossus, and disappears in the Tongue. By the Action of these Muscles, the whole Tongue is moveable in all Directions, and capable of figuring its own Substance so as to form a Concavity by the Elevation of the Hyo-Glossi, which it again flattens by the Cerato-Glossi, but contracts itself into a narrow and almost cylindrical Figure, by the transverse Fibres from one Side to the other, together with which there are many other Orders of Fibres intermixed with a thick Fat; so that they cannot be traced in the human Tongue.

The Arteries of the Tongue are numerous: One, that is larger and deeper than the rest, ascends, in a serpentine Direction, from the external Carotid, and extends to the Apex of the Tongue; and a lesser superficial Artery, incumbent on the sublingual Gland, either arises from, or inosculates with, the preceding; or else there are various small Branches, derived from the posterior Labials, and from the Branches proper to the Lips, or those of the Tonsils.

The Veins are variously wove, and difficult to describe; some of which, lying deep, accompany the Nerve of the ninth Pair; and others, that are superficial, accompany the mental Artery; and, inosculating with the former, sends out the ranular Vein; but all of them meet together in a large Vein, which is one Branch of the internal jugular coming from the Brain.

These Veins communicate variously with the adjacent Complications or reticular Parts belonging to the Tonsils, Pharynx, thyroïd Gland, and Skin; and in the posterior Part of the Tongue, before the Epiglottis, there is a Communication

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between the right and left Sides of the venal Plexus.

The Papillæ of the Tongue, which are larger and softer than those of the Skin, and perpetually moist, perform the Office of Touch more exquisitely than those of the small and dry cutaneous Papillæ; hence the Tongue is liable to a sharper Degree of Pain: Moreover, naked Salts are not otherwise perceived than under a Sense of Moisture or Pain: But these Papillæ, being raised a little protuberant, to perform the Office of Taste from Salts dissolved in Water or Saliva, and applied against their Apices or Summits, are affected in a particular Manner; which being distinguished by the Mind, and referred to certain Classes, are called Flavours, or Tastes; either sour, sweet, rough, bitter, saline, urinous, spirituous, aromatic, pungent, or acrid; with others, of various Kinds, resulting partly from pure Salts, and partly from an Intermixture of the subtil animal or vegetable Oils variously compounded, and changing each other: But all caustic Salts, or such as are acrid in a high Degree, excite Pain, instead of Taste.

If it be enquired, Whether the Diversity of Flavours arises from the different Figures which are natural to Salts? and, Whether this does not appear from the cubical Figure into which Sea Salt shoots, the prismatical Figure of Nitre, or the particular Configuration of Vitriol, Sugar, &c.? We answer, That this does not seem probable; for even tasteless Chrystals have their particular Configurations; and the Taste arising from very different Salts and differently qualified Objects of this Sense, are too much alike each other, and, at the same Time, too inconstant or changeable to allow such a Theory; for Example, in Nitre.

The mechanical Reason, therefore, of the Diversity of Flavours, seems to reside in the intrinsic Fabric or Apposition of their Elements, which do not become the Object of our Senses.

But the Nature or Disposition of the Covering with which the Papillæ are cloathed, together with that of the Juices and Aliments lodged in the Stomach, have a considerable Share in determining the Sense of Taste; insomuch, that the Flavour does not equally please or affect the Organ, in all Ages, alike, nor in Persons of all Temperatures, nor even in one and the same Person at different Times, who shall be differently accustomed in Health, or variously diseased. In general, whatever contains less Salt than the Saliva itself, seems insipid.

The spirituous Parts, more especially of Vegetables, either penetrate into the Papillæ themselves, or else are absorbed by the adjacent Pile of Villi of the Tongue, as appears from the speedy Recruit of the Strength by vinous or aromatic Liquors of this Kind, even before they are received into the Stomach.

Nature designed the Difference of Flavours to be felt by the Tongue, that we might know and distinguish such Foods as are most salutary: For, in general, there is not any one Kind of Aliment healthy, that is of a disagreeable Taste; nor are there any ill tasted that are fit for our Nourishment: For it must be observed, that we here take no Notice of the Excess by which the most healthy Food may be prejudicial. In this Manner Nature has invited us to take necessary Food, as well by that Pain called Hunger, as by the Pleasure arising from the Sense of Taste. But brute Animals, that have not, like ourselves, the Advantage of learning from each other by Instruction, have the Faculty of distinguishing Flavours more exquisitely;

quisitely; by which they are admonished to abstain cautiously from poisonous or unhealthy Food: And hence it is that herbivorous Cattle, to which a great Diversity of noxious Plants are offered amongst their Food, are furnished with such large and long Papillæ, of so elegant a Structure in the Tongue, of which we have less Need. HALLER. Prim. Lin. Physiolog.

REMARK.

Sometimes Tumors happen about the Tongue, which, if not taken Care of in Time, degenerate into Ulcers and Cancers, when a Cure can rarely be obtained.

I have seen Persons to whom the Tongue, being wounded, either by Biting, or a broken Tooth only, has proved of very bad Consequence; as this Organ is so much interspersed with nervous Papillæ, &c.





LECTURE III.

Of the SALIVAL GLANDS, and the Organ of SMELLING.

BY SALIVA, we mean, in general, that Fluid by which the Mouth and Tongue are continually moistened, in their natural State. This Fluid is chiefly supplied by Glands, called, for that Reason, GLANDULÆ SALIVALES, of which they commonly reckon three Pairs; two PAROTIDES, two MAXILLARES, and two SUBLINGUALES. These are, indeed, the largest, and furnish the greatest Quantities of Saliva; but there is a great Number of other lesser Glands of the same Kind, that may be reckoned Assistants or Substitutes to the former. All these may be termed SALIVAL GLANDS, and are enumerated in the following Manner:

The PAROTIDES are two large whitish Glands, irregularly oblong and protuberant, situated, on each Side, between the external Ear and the posterior or ascending Ramus of the inferior Maxilla, and lying on some Part of the adjacent masseter Muscle. The superior Portion of this Gland lies anterior of the cartilaginous Meatus of the Ear, and touches the Apophysis Zygomatica of the Os Temporis; and is extended, anteriorly and posteriorly, under the Lobe of the Ear, as far as the mastoid Apophysis.

From

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From the anterior and superior Portions of this Gland a white membranous Duct or Canal is produced, by the Union of a great Number of small Tubes, representing so many Roots: This Duct runs anteriorly oblique on the external Side of the Masseter, and then perforates the Buccinator, from without internally, opposite to the Interstice between the second and third Dentes Molares, where the Orifice represents the Spout of a Ewer.

This Canal is named *Ductus Salivalis Stenonis*, or *Ductus Superior*: It is about the twelfth Part of an Inch in Diameter, and, in some Subjects, is partly covered by small glandular Bodies, united with it in different Quantities. The Arteria and Vena Angularis ascend. over this Duct, and the Portio Dura of the auditory Nerve runs thro' the Gland itself; and it also receives Filaments from the second vertebral Pair.

The MAXILLARY GLANDS are smaller and rounder than the Parotides, and are situated each, on the internal Side of the Angle of the inferior Maxilla, near the Musculus Pterygoïdæus Inferior: From the internal Side, or that which is turned to the Musculus Hyo-Glossus, each of them sends out a Duct in the same Manner as the Parotides; but it is smaller and longer, and is named *Ductus Salivalis WHARTONI*, or *Ductus Inferior*.

This Duct advances, on the Side of the Musculus Genio-Glossus, along the internal Part and superior Margin of the Glandula Sublingualis, to the Frænum of the Tongue, where it terminates by a small Orifice in Form of a Papilla.

The GLANDULÆ SUBLINGUALES are likewise two in Number, of the same Kind with the former, only smaller, somewhat oblong, and flatted like a blanch'd Almond: They are situated under the anterior Portion of the Tongue, one on each Side, near the inferior Maxilla, on the lateral Portions

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tions of the Musculi Mylo-Hyoïdæi which sustain them: The two Extremities of each Gland are turned posteriorly and anteriorly, and the Margins internally and externally oblique.

They are covered, on the superior Side, by a very thin Membrane, which is a Continuation of the Membrane that covers the inferior Side of the Tongue: They send out laterally several small short Ducts, which open, near the Gums, by the same Number of Orifices, all ranked in the same Line, at a small Distance from the Frænum, and a little more posteriorly. In many Animals we find particular Ducts belonging to these Glands, like those of the Glandulæ Maxillares, but they are not to be found so distinctly in Men. The Musculi Genio-Glossi lie between the two sublingual Glands, and also between the two maxillary Ducts.

The MOLARES are two Glands nearly of the same Kind with the former, each of them being situated between the Masseter and Buccinator; and, in some Subjects, they may easily be mistaken for two small Lumps of Fat. They send out small Ducts which perforate the Buccinator, and open into the Cavity of the Mouth, almost over-against the last Dentes Molares; and thence HEISTER, who first described them, called them Glandulæ Molares.

All the internal Surface of the Cheeks near the Mouth is full of small glandulous Bodies called GLANDULÆ BUCCALÆ, which open, by small Orifices, through the internal Membrane of the Mouth: The Membrane that covers the internal Surface of the Lips, a Continuation of that on the Cheeks, is likewise perforated by a great Number of small Apertures, which answer to the same Number of small Glands called GLANDULÆ LABIALES. The GLANDULÆ LINGUALES are those
of

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of the Foramen Cæcum of the Basis of the Tongue that have been already spoken of.

The GLANDULÆ PALATINÆ are those that belong to the Curvature and Septum of the Palate, and the GLANDULÆ ARYTENOÏDÆÆ were described with the Larynx.

The UVULAR GLANDS are only a Continuation of the Membrane of the Palate in Form of a small Bunch of Grapes.

We might likewise reckon, among the salival Glands, those of the superior Portion of the Pharynx, mentioned in the Description of that Part; and also the glandular Bodies of the Membrana Pituitaria of the Nares, and of the Sinuses that communicate with these.

The AMYGDALÆ are two glandular Bodies, of a reddish Colour, lying in the Interstices between the two lateral Semi-curvatures of the Septum Palati, one on the right, the other on the left Side of the Basis of the Tongue: Their Appearance is not unlike that of the external Surface of an Almond Shell, both because their Surface is uneven, and because it is full of Foramina big enough to admit the Head of a large Pin.

These Foramina, which represent a Sieve, or reticular Work, are continued to an irregular Sinus, or Cavity, within the Gland, commonly filled with a viscid Fluid that comes from the Basis of the Sinus, and is from thence gradually discharged thro' these Apertures into the Throat. To see the Structure of the Amygdalæ, they must be examined in clear Water, having first been washed in luke-warm Water, and handled very gently.

The THYROID GLAND is a large whitish Mass that covers the anterior convex Surface of the Larynx. It seems, at first Sight, to be composed of two oblong glandular Portions, united, by their inferior Extremities, below the cricoid Cartilage,

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in such a Manner, as to have some Resemblance to a Crescent, with the Cornua turned superiorly : It is of a moderate Thickness, and bent laterally like the thyroïd Cartilage, from which it takes its Name. The two lateral Portions lie on the Musculi Thyro-Hyoïdæi, and the middle or inferior Portion on the Crico-Thyroïdæi; the Thyro-Pharyngæi Inferiores send Fibres over this Gland, and they communicate on each Side, by some such Fibres, with the Sterno-Thyroïdæi and Hyo-Thyroïdæi.

This Gland seems to be of the same Kind with the other salival Glands, but it is more solid. Some Anatomists thought they had discovered the excretory Duct, but they mistook a Blood Vessel for it. We sometimes meet with a kind of glandular Ligament that runs before the Cartilago Thyroïdes, and disappears before the Basis of the Os Hyoïdes.

This glandular Duct goes out from the common Basis of the lateral Portions of the thyroïd Gland, and is lost between the Musculi Sterno-Hyoïdæi, posterior of the Basis of the Os Hyoïdes, or between that Basis and the Epiglottis*.

OF THE NOSE.

The Parts of which the NOSE is composed may be divided two Ways; viz. from their Situation, into internal and external Parts; and, from their Structure, into hard and soft Parts.

* WINSLOW has long since demonstrated, in his private Courses, the small Openings on the Side of the anterior Ligament of the Epiglottis, or that by which it is connected to the Basis of the Tongue. One of these Openings appears like a small Papilla; and this is the farthest that he has been able to trace the glandular Duct.

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The external Parts are, the Root, Curvature, Back or Spine, Sides of the Nose, or of the Curvature, Tip of the Nose, Alæ, external Nares, and that Part under the Septum.

The internal Parts are, the internal Nares, Septum Narium, Circumvolutions, Conchæ Superiores, Conchæ Inferiores, posterior Openings of the internal Nares, Sinus Frontales, Sinus Maxillares, Sinus Sphenoïdales, Ductus Lacrymales, and Ductus Palatini.

The firm or hard Parts are mostly osseous, and the rest cartilaginous.

The soft Parts are, the Integuments, Muscles, Sacculus Lacrymalis, Membrana Pituitaria, Vessels, Nerves, and Hairs of the Nares.

The INTERNAL NARES, or two Cavities of the Nose, comprehend the whole Space between the external Nares and posterior Openings, immediately above the Concavity of the Palate, from whence these Cavities ascend as far as the Lamina Cribrosa of the Os Ethmoides, where they communicate anteriorly with the Sinus Frontales, and posteriorly with the Sinus Sphenoïdales. Laterally these Cavities are bounded on the internal Side by the Septum Narium, and on the external, or that next the Cheeks, by the Conchæ, between which they communicate with the Sinus Maxillaris.

The particular Situation of these Cavities deserves our Attention. Their Basis runs directly posterior, so that a strait and pretty large Stilet may easily be passed from the external Nares under the great Apophysis of the occipital Bone; the Openings of the maxillary Sinuses are nearly opposite to the superior Margin of the Ossa Maxillarium; the Openings of the frontal Sinuses are more or less opposite to, and between the Pulleys or Rings of the Musculi Trochleares; and by these

these Marks the Situation of all the other Parts may be determined.

The inferior Portion of the external Nose is composed of several Cartilages, which are commonly five in Number, and of a pretty regular Figure; the rest are only additional, smaller, more irregular, and the Number of them more uncertain. Of the five ordinary Cartilages, one is situated in the Middle, the other four laterally. That in the Middle is the most considerable, and supports the rest, being connected immediately to the osseous Parts; but the other four are connected to the middle one, and to each other, by means of Ligaments.

The principal Cartilage of the Nose consists of three Parts; one middle, and two lateral. The middle Portion is a broad cartilaginous Lamina, connected, by a kind of Symphysis, to the anterior Margin of the middle Lamina of the Os Ethmoides, the anterior Margin of the Vomer, and to the anterior Part of the Groove formed by the *Ossa Maxillaria*, as far as the nasal Spines of these Bones; this Lamina completes the *Septum Nasium*, and forms the principal Part thereof.

The lateral Portions are oblique and narrow, suited to the corresponding Parts of the osseous Curvature: Where they join the middle Lamina, a superficial Groove is observable, which makes them sometimes appear like two distinct Pieces separated from the Lamina, tho' they are really continuous. This shallow Groove terminates inferiorly by a small Crista.

The lateral Cartilages are two, on each Side of the inferior Part of the Lamina; one anterior, the other posterior: The anterior ones are very much bent anteriorly, and form what is called the Tip of the Nose, the Space between their incurvated Extremities being commonly filled with a kind of fatty

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fatty Substance: The two posterior ones form the Alæ of the Nares; being pretty broad, and of an irregular Figure.

The Spaces left between some Portions of the anterior and posterior Cartilages, those between the posterior ones and the adjacent Parts of the Offa Maxillaria, and those between these four lateral Cartilages and the principal Lamina, vary in different Subjects, and are filled by small additional Cartilages, the Number, Size, and Figure, of which, are as variable as the Interstices in which they lie.

The SUB SEPTUM, or Portion under the Septum Narium, is a Column of Fat applied to the inferior Margin of the cartilaginous Partition, in Form of a soft moveable Appendix: The Thickness of the Alæ Narium, and especially that of their inferior Margin, is not owing to the Cartilages that are very thin, but to the same kind of solid Fat with which these Cartilages are covered. The great Cartilage is immoveable, by reason of its firm Connexion to the osseous Parts of the Nose; but the lateral Cartilages are moveable, because of their ligamentary Connexions; and they are moved, in different Manners, by the Muscles belonging to them.

The external Nose is covered by the common Integuments, Skin, Epidermis, and Fat: These, which cover the Tip of the Nose and Alæ Narium, are a great Number of glandular Bodies, called Glandulæ Sebaceæ by MORGAGNI, the Contents of which may easily be squeezed out by the Fingers: All these osseous and cartilaginous Parts have likewise the common Periosteum or Perichondrium.

Six Muscles (already described with those of the Face) are commonly reckoned to belong to the Nose: Two Recti, called also Pyramidales, or Tri-

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Triangulares; two Obliqui, or Laterales; and two Transversi, or Myrtiformes. In very muscular Bodies there are, likewise, some supernumerary Muscles, or small Accessorii. The Nose may also be moved, in some measure, by the Muscles of the Lips, which, in many Cases, become Assistants to the proper Muscles of this Organ.

The MEMBRANA PITUITARIA * is that which lines the whole internal Nares, cellular Convolutions, Conchæ, Sides of the Septum Narium, and, by an uninterrupted Continuation, the internal Surface of the Sinus Frontales and Maxillares, and that of the Ductus Lacrymales, Palatini, and Sphenoïdales: It is likewise continued, inferiorly, from the Nares to the Pharynx, Septum Palati, &c.

When we carefully examine this Membrane, it appears to be of a different Structure in different Parts. Near the Margin of the external Nares it is very thin, appearing to be the Cutis and Epidermis in a degenerated State; all the other Parts, in general, are spongy, and of different Thicknesses. The thickest Parts are those on the Septum Narium, on the entire inferior Portion of the internal Nares, and on the Conchæ; and if we make a small Aperture in it, at any of these Places, and then blow through a Pipe, we discover a very large cellular Substance: In the Sinuses it appears to be of a more slender Texture.

On that Side next the Periosteum and Perichondrium it is plentifully furnished with small Glands, the excretory Ducts of which are very long near

* It is termed Pituitaria, because, through the greatest Part of its large Extent, it serves to separate from the arterial Blood a mucilaginous Lympha, called Pituita by the Antients, which, in its natural State, is pretty liquid; but it is subject to very great Changes, becoming sometimes glutinous, sometimes limpid, &c. neither is it separated in equal Quantities through the whole Membrane.

the Septum Narium, and their Orifices very visible*.

The FRONTAL MAXILLARY and sphenoid Sinuses open into the internal Nares, but in different Manners; the frontal Sinuses open from the superior Part to the inferior, answering to the Infundibula of the Os Ethmoïdes; the Sphenoïdales open anteriorly, opposite to the posterior Orifices of the Nares; and the Maxillares open, a little more superiorly, between the two Conchæ: Therefore the Sinus Frontales discharge themselves most readily when we stand or sit, and the Sphenoïdales when the Head is inclined anteriorly.

The SINUS MAXILLARES cannot be emptied wholly, or both at the same Time, in any one Situation: Their Opening, which in some Subjects is single, in others double, &c. lies exactly between the two Conchæ, about the Middle of their Depth; so that when the Head is held strait, or inclined anteriorly or posteriorly, they can only be half emptied; but, when we lie on one Side, the Sinus of the opposite Side may be wholly emptied, the other remaining full.

It is proper to observe here the whole Extent of the maxillary Sinus. Inferiorly there is but a very thin Partition between it and the Dentes Molares, the Roots of which do, in some Subjects, perforate that Septum; superiorly there is only a very thin transparent Lamina between the Orbit and the Sinus; posteriorly, above the Tuberosity of the Os Maxillare, the Sides of the Sinus are very

* By applying a Pipe to any of these Orifices, the Ducts may be blown up almost through their whole Extent; but, in order to this, the Parts must first be very well cleaned, and washed in lukewarm Water.

In these Places, especially, we likewise discover a very fine villous Substance, when the Parts are examined in clear Water, in the Manner which has been described in another Place.

thin,

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thin, especially at the Place that lies before the Root of the Apophysis Pterygoïdes, thro' which the inferior maxillary Nerve sends down a Ramus to the Foramen Palatinum Posterius, commonly called Gustatorium; interiorly, or towards the Conchæ Narium, the osseous Part of the Sinus is likewise very thin.

The *SACculus LACRYMALIS* is an oblong membranous Bag into which the serous Fluid is discharged from the Eye thro' the *Puncta Lacrymalia*, and from which the same Fluid passes to the inferior Part of the internal Nares. It is situated in an osseous Sinus and Canal, formed partly by the Apophysis Nasalis of the *Os Maxillare* and *Os Unguis*, partly by the same *Os Maxillare* and inferior Part of the *Os Unguis*, and partly by this inferior Portion of the *Os Unguis* and a small superior Portion of the *Concha Narium Inferior*. This Sinus and Canal are the osseous lacrymal Duct.

We are farther to observe here, concerning the Situation of this osseous Duct, that it descends, for a little way obliquely backwards, towards the inferior and lateral Part of the internal Nares on each Side, where its inferior Extremity opens, on one Side of the *Sinus Maxillaris*, under the inferior *Concha*, nearly at the Place from which a perpendicular Line would fall in the Interstice between the second and third *Dentes Molares*. The superior Part of this Duct is only a Semi-canal, or Sinus; the inferior is a complete Canal, narrower than the former.

The *Sacculus Lacrymalis* may be divided into a superior or orbitary Portion, and an inferior or nasal one. The orbitary Portion fills the whole osseous Sinus, being situated immediately behind the middle Tendon of the *Musculus Orbicularis*: About one Fourth of its Length is above this

Tendon, and the rest below. The nasal Portion lies in the osseous Canal of the Nose, being narrower and shorter than the former.

The orbital Portion is disposed, at its superior Extremity, much in the Manner of an Intestinum Cæcum; and, at the inferior Extremity, is continued with the Portio Nasalis. Towards the internal Angle of the Eye, behind the Tendon of the orbicular Muscle, it is perforated by a small short Canal formed by the Union of the lacrymal Ducts.

The nasal Portion, having reached the inferior Part of the osseous Duct under the Concha, terminates in a small flat membranous Bag, the Basis of which is perforated by a circular Aperture, as to be always found, upon a careful Examination; but which, at first Sight, appears oblong.

WINSLOW used to attribute this Difference to the Force which he was obliged to use in separating the Concha Inferior, in order to see this Aperture, which he often found more backward than the Middle of the Bag at the Extremity of this Portion; and therefore, when he would either see or shew this Aperture in its natural State, he did not separate the inferior Concha, but cut it gently with a sharp Knife, or Scissars. If a transverse Line be drawn between the inferior Part of the Nose and Os Malæ, and another Line be drawn, superiorly direct, opposite to the third Dens Molaris, or to the second and third; these two Lines will intersect each other nearly at the inferior Extremity of this Sacculus.

He also has sometimes found the superior Extremity of this Bag divided into an interior and posterior Part by a kind of Valvula Connivens lying in the anterior Portion, a little more inferior than the Tendon of the Musculus Orbicularis. The small common Canal of the two lacrymal Ducts

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Ducts opens in the posterior Portion, and, consequently, behind the Valve.

The Substance of this Sacculus is somewhat spongy or cellulous, and pretty thick, being strongly connected, by its convex Side, to the Periosteum of the osseous Canal, which may be distinctly shewn. This Substance seems to be composed of two Laminæ, connected by a spongy Membrane, the external of which is that already mentioned; the other appears to be glandulous, and is, in some Subjects, loose and pliable, which is looked upon as diseased.

The DUCTUS INCISORII, or NASO-PALATINI, of STENO, are two Canals that go from the Basis of the internal Nares cross the Curvature of the Palate, and open behind the first or largest Dentes Incisorii: Their two Orifices may be distinctly seen in a Skeleton at the inferior Part of the nasal Fossæ, on the anterior Sides of the Cristæ; and we may likewise perceive their oblique Passage through the maxillary Bones; and, lastly, their inferior Orifices in a small Cavity, or Fossula, called Foramen Palatinum Anterius. In fresh Subjects they are not so apparent; in Sheep and Oxen they are easily seen.

OBSERVATION.

SANTORINI (in his Anatomical Observations) has described those of the human Body in a very pretty Manner, and given us his Method of discovering them, which is nearly the same with that of Professor WINSLOW: For, instead of dividing the Head into two equal lateral Parts, WINSLOW always directs the Saw a little towards one Side, to preserve the Septum Narium entire, as well as that of the Sinus Frontales, Sinus Sphenoïdales, and on the other Side, to preserve the Conchæ and Cells of the Os Ethmoïdes. For this Purpose,

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we use a very fine Saw made of the Spring of a Watch.

By this Method we shew, on that Side from which all the Septa have been sawed off, the entire Conchæ, their convex Sides, the particular Thickness of the Membrana Pituitaria on their inferior Margins, the Orifice or Orifices of the Sinus Maxillaris, the Situation of the Orifice of the Sinus Sphenoïdalis, the communicating Ducts that go between the Sinus Frontales and ethmoïd Cells, and Interstices between the two Conchæ, and the Structure of the posterior Apertures of the Nares : And can shew likewise, at the same Time, the Orifice of the EUSTACHIAN Tube behind the posterior Opening of the Nares, and the Communication of the Nose with the Mouth.

On the same Side we afterwards separate gradually, with a very sharp Knife, or narrow sharp-pointed Scissars, the superior or ethmoïd Concha, without doing Violence to the adjacent Parts ; and then we see, on the Parts covered by that Concha, a little oblong or oval Fossula, that descends obliquely from before backwards ; at the posterior and inferior Extremities of which there is an Orifice, of about a Quarter of an Inch in Diameter, which opens into the maxillary Sinus ; and another, at the anterior or superior Extremity, which opens into the frontal Sinus. WINSLOW.

Immediately behind this Fossula there are two Apertures, one into the Sinus Frontales, the other into the ethmoïd-Cellulæ of the Os Frontis ; there are likewise, in the posterior Part of the Os Ethmoïdes, two Apertures, by which the Cells of that Bone communicate with each other : All this is very different from what we see in the Skeleton, or even when these Parts are deprived of their Membranes, &c. neither is the Structure always the same in fresh Subjects ; for in some I have
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observed, a little before and above the Opening of the maxillary Sinus, two small Sinuses, which connected, in their Passage, with the frontal Sinuses, the superior one being a little contorted.

Then the Concha Inferior, or Maxillaris, must be removed, with great Precaution; where may be observed, at the Distance of about a Quarter of an Inch from the anterior Extremity of this Concha, a small Opening, the Diameter of which is not above a twelfth Part of an Inch, and is turned posteriorly oblique. It seems to be the Extremity of a Duct of the same Diameter; but, when it is slit with sharp-pointed Scissars, a flat oval Cavity is seen, the Diameter of which is a Quarter of an Inch in Length, and lies in the same Direction with the Septum Narium.

This oval Cavity is the inferior Extremity of the Sacculus Lacrymalis, which, consequently, is only contracted between this inferior Cavity and the orbitary Portion: Within this narrow or contracted Portion is likewise seen the Opening of a blind Duct, which runs obliquely, posteriorly and superiorly, for about a Quarter of an Inch; but it is not known precisely where it terminates, nor what it is designed for.

The Nose is the Organ of Smelling, by means of the villous Portion of the internal Membrane, to which the olfactory Nerves are chiefly distributed: It is likewise of Use in Respiration; and the mucilaginous Fluid, spread over the whole pituitary Membrane, prevents the Air from drying that Membrane, and so rendering it incapable of being affected.

The Nose serves, likewise, to regulate and modify the Voice; and to this the Sinuses likewise contribute.

The Sacculus Lacrymalis receives the Serum from the Eyes, and discharges it upon the Palate,

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from whence the greatest Part of it runs to the Pharynx.

The Nerves of the Nose, being almost naked, require a Defence from the Air, which is continually drawn through the Nostrils by the Use of Respiration; Nature has therefore supplied this Part, which is the Organ of Smelling, with a thick insipid Mucus, very fluid in its first Separation, and not at all saline, but by the Air condenses into a thick dry Crust, more consistent here than in other Parts of the Body: By this Mucus, the Nerves are defended from drying, and guarded from Pain: It is poured out from many small Arteries of the Nostrils, and deposited partly into numerous cylindrical Ducts, and partly into round visible Criptæ, or Cells, whence it flows out all over the Surface of the olfactory Membrane, which is therewith moistened.

In the Septum descends, anteriorly, a long Sinus, to a considerable Length, which is common to many muciferous Pores; this Mucus is accumulated in the Night-time, but, in the Day, expelled by blowing the Nose, or sometimes, more powerfully, by Sneezing; and offends by its Excess or Tenuity, or irritates by its too great Thickness the very sensible Nerves; whence Sneezing is excited for its Removal. But the Sinuses of this Part, which abound with Mucus, are this way variously evacuated, agreeable to the different Postures of the Body, by which always some of them are at Liberty to free themselves, whether the Head be erect, or inclined anteriorly or laterally; yet so that, generally, the maxillary sphenoid Sinuses are more difficultly emptied than the rest. Moreover, the Tears descend, by a proper Canal, into the Cavity of the Nose; by which means they moisten and dilute the Mucus.

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At the Extremities of the Nares, or Organs of Smelling, is prefixed the Nose, lined internally with a Membrane, of the same Nature, composed of two Bones, and usually six Cartilages (already described), which render the Nose moveable, by its proper Muscles, so as to be raised and dilated by a Muscle common to the superior Lip, and to be contracted together into a narrower Compass by the proper depressor and compressor Muscle pulling down the Septum, as we observed in describing those Muscles: Thus it forms an aerial Engine, which, for the Reception of Odours, can take in a larger Quantity of Air by dilating, than contracting by Elasticity, when the Air is afterwards abundantly driven out.

The Air, therefore, filled with the subtil and invisible Effluvia of Bodies, consisting of their volatile, oily, and saline Particles, is, by the Power of Respiration, urged through the Nose, so as to apply the said Particles to the almost naked and constantly soft olfactory Nerves, in which a kind of Feeling is exciting, which is named Smelling; and, by this Sense, we distinguish the several Kinds of Oils, Salts, and other Matters, difficultly reducible to Classes, which hereby we perceived indistinctly; whence they are difficultly recalled to Memory, though the Odours, already established, are sufficient for our Purposes.

This Sense serves to admonish us of any pernicious Putrefaction, violent Acrimony, or of a mild, safe, and useful Disposition in Bodies. And as Salt, joined with an Oil, is the Rudiment of Taste; so a volatile Oil, aided by Salts, serves to excite Smells: Whence the Affinity of the two Senses, which conjunctly assist each other, may be easily understood. But Particles, which excite Smelling, are more volatile; as those, belonging to Taste, are more fixed: Whence the Difference
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in these Organs may, possibly, consist in the thick mucous Cuticle which, being spread over the Tongue, intercepts the Action of the more subtil saline Effluvia from acting upon the Taste; which yet easily affect the softer and less covered Nerves of the internal Nose.

Smells have a very strong Action, but of short Continuance; because they are applied immediately, by the most minute Particles, to Nerves which are very near the Brain itself, and almost naked: Thence, too, proceeds the Force of poisonous Vapours, and the Refreshment from agreeable Odours, by which some Persons are effectually restored to themselves out of a deadly Swoon, or even after Drowning.

From hence comes that violent Sneezing, that often arises from acrid Particles; and a Looseness, or Purging of the Bowels, from the Smell of some Medicines; with the Power of particular Antipathies: And hence is derived the pernicious Effects of excessive Sneezing, more especially Blindness, from a near Consent or Communication of the Nerves; and, amongst the Parts of the Nose, the Septum, especially the Os Turbinatum, have a more considerable Share in the Organ of Smelling; since these Parts are multiplied in quick-scented Animals, so as to form beautiful Spires in Hounds, and other Quadrupedes: And in Fishes, which smell in Water, they are formed, like the Teeth of a Comb, in an elegant Manner. HAL-
LER. Prim. Lin. Physiol.

OBSERVATIONS.

Polypuses are Excrescences that sometimes arise in the Nose. They vary, according to the different Causes that produce, and the Alterations may have happened in them.

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Sometimes a Polypus is owing to a Swelling of the pituitary Membrane, which Inflammation may possess a greater or less Space of the Membrane, as also its cellular Substance, and may affect either one or both the Nostrils: It may also be produced from a Caries of the adjacent Bones.

Of whatever Nature Polypuses be, they intercept the Passage of Air through the Nostril; and, when large, force the Septum Narium into the other Nostril; so that the Patient is unable to breathe, unless it be through the Mouth.

A large Polypus pressing, in like Manner, upon the Laminæ Spongiosæ, or Ossa Turbinata, gradually forces them down upon the Ossa Maxillaria, and thereby compresses and obstructs the Orifice of the Ductus Lacrymalis: Nor is it impossible for the Sides of the Canalis Nasalis to be compressed. In this Case, the Tears, having no Admittance thro' the Sacculus Lacrymalis, nor being able to exclude its Contents, is sometimes so much dilated, as to form what is called a flat Fistula. Instances have happened of Polypuses being so large, as to thrust down the Palate Bones.

Authors of Veracity mention Polypuses of enormous Bulks. Vid. RIOLANUS FABRICIUS AQUAPENDENTUS, Hist. l'Acad. Royal des Scien, Ann. 1704, LE DRAN. Chirurg. Obs. &c.



LECTURE IV.

Of the Organs of HEARING.



AS the Sense of SMELLING distinguishes odoriferous Corpuscles which float in the Air; so that of HEARING conceives the elastic Tremors, or Impulsions, of the Air itself. Therefore we observe the sensitive Organ of the EAR to be formed in a different Manner from that of any other Sense, as it is composed, for the most Part, either of osseous, or elastic cartilaginous Substances.

The EXTERNAL EAR, taken all together, resembles, in some sort, the Shell of a Mussel, with its broad End turned superiorly, the small one inferiorly; the convex Side next the Head, and the concave Side externally.

Two Portions are distinguished in the external Ear, taken all together; one large and solid, called in Latin Pinna, which is the superior, and by much the greatest Part; the other small and soft, called the Lobe, which makes the inferior Part.

We may likewise consider two Sides in the external Ear; one turned anteriorly oblique, and irregularly concave; the other turned posteriorly oblique, and unequally convex: For all Ears, which have not been disordered by binding the Head too tight in Childhood, are naturally bent anteriorly.

The anterior Side is divided into Eminences and Cavities. The Eminences are four in Number; called **HELIX**, **ANTI-HELIX**, **TRAGUS**, and **ANTI-TRAGUS**. The Helix is the large folded Border or Circumference of the great Portion of the Ear: The Anti-helix is the large oblong Eminence or Rising surrounded by the Helix: The Tragus is the small anterior Protuberance below the anterior Extremity of the Helix, which, in an advanced Age, is covered with Hairs: The Anti-tragus is the posterior Tubercle below the inferior Extremity of the Anti-helix.

The anterior Cavities are four in Number; the Concavity of the Helix, the Depression at the superior Extremity of the Anti-helix called **Fossa NAVICULARIS**, the Concha or great double Cavity that lies under the Rising called Anti-helix, the superior Basis of which is distinguished from the inferior by a Continuation of the Helix in Form of a transverse Crista; and, lastly, the Meatus of the external Ear situated at the inferior Part of the Basis of the Concha.

The posterior Side of the external Ear shews only one considerable Eminence, which is a Portion of the convex Side of the Concha, the other Portion being hid by the Adhesion of the Ear to the Os Temporis. This Adhesion hinders us from seeing the Cavity answering to the Crista, by which the Cavity of the Concha is divided.

It has been already said, that the external Ear consists chiefly of a Cartilage, which is the Basis of all the other Parts. These other Parts are Ligaments, Muscles, Integuments, sebaceous and ceruminous Glands, Arteries, Veins, and Nerves.

The Cartilage of the external Ear is nearly of the same Extent and Figure with the large solid Portion thereof already mentioned, but it is not of the same Thickness, being covered by Integuments

guments on both Sides. In the Lobe or soft inferior Portion of the Ear this Cartilage is absent; on the posterior Side it shews all the Eminences and Cavities on the anterior Side in an opposite Situation with respect to each other, except the Plica of the great Circumference; and it consists only of one Piece from that Circumference all the Way to the Meatus Externus, except at the two Extremities of the folded Part of the Helix, where there are two small separate Portions connected to the great Cartilage only by the Integuments.

The cartilaginous Portion of the external Meatus Auditorius does not make a complete Circle, but rather a short Tube, in one Side of which there is a Break, which terminates in an oblique Border fixed to the Margin of the osseous Canal, by several small Inequalities, as by a kind of In-grailing; and from this Obliquity it is, that the cartilaginous Border terminates inferiorly in a kind of Apex. The lateral Break in this Cartilage is between the superior and posterior Part of its Circumference, and on each Side thereof the cartilaginous Margins are rounded; there are likewise two or three other small Incisures in this Circumference, which, with regard to the Meatus, represent obliquely transverse Fissures. The anterior Fissure is, in a manner, quadrangular; nor are the intermediate Parts always opposite to each other, for the superior is a little farther from the Os Temporis than the posterior.

The external Ear is fixed to the Cranium, not only by the cartilaginous Portion of the Meatus already mentioned, but also by Ligaments, which are two in Number, one anterior, the other posterior. The anterior Ligament is fixed, by one Extremity, to the Root of the Apophysis Zygomatica of the Os Temporis at the anterior, and a little towards the superior Part of the Meatus Osseus,

feus, close to the Corner of the glenoïd Cavity; and, by the other, to the anterior and superior Parts of the cartilaginous Meatus.

The posterior Ligament is fixed, by one Extremity, to the Radix of the mastoïd Apophysis; and, by the other, to the posterior Part of the Convexity of the Concha, so that it is opposite to the anterior Ligament: There is likewise a kind of superior Ligament, which seems to be only a Continuation of the Aponeurosis of the frontal and occipital Muscles.

Of the Muscles of the external Ear, some go between the Cartilages and Os Temporis, others are confined to the Cartilages alone: Both Kinds vary in different Subjects, and are sometimes so very thin, as to look more like Ligaments than Muscles. The Muscles of the first Kind are generally three in Number; one superior, one posterior, and one anterior; and they are all very thin. The superior Muscle is fixed in the Convexity of the Fossa Navicularis, and of the superior Portion of the Concha, from whence it ascends to the squamous Portion of the Os Temporis, expanding, in a radiated Manner, tho' not in the same Degree in all Subjects, and is inserted, principally, in the ligamentary Aponeurosis, which covers the posterior Portion of the temporal Muscle.

The anterior Muscle is small, more or less inverted, and like an Appendix to the superior. It is fixed, by one Extremity, above the Radix of the zygomatic Apophysis; and, by the other, in the anterior Part of the Convexity of the Concha.

The posterior Muscle is almost transverse, and of a considerable Breadth; being fixed, by one Extremity, to the posterior Part of the Convexity of the Concha; and, by the other, in the Radix of the mastoïd Apophysis. It covers the posterior

Ligament: But the Division of it into several Portions, mentioned by some Authors, seems to be merely artificial; that is, owing to Dissection.

The small Muscles, which are connected to the Cartilages, are only small Strata of Fibres found on both Sides of them. In many Subjects they are of so pale a Colour, as not to look at all like muscular Fibres. Of this Number are those that VALSALVA discovered in the different Cavities on the posterior Side of the Cartilage, and those found by SANTORINI on the Tragus, and along the convex Part of the anterior Portion of the Helix.

The Skin of the external Ear is, in general, a Continuation of that which covers the circumjacent Parts of the temporal Region; that on the anterior Part of the Ear is accompanied by a very small Quantity of cellular Substance; and therefore we find all the Eminences and Cavities of that Part distinctly marked upon it, as far as the Basis of the external Meatus Auditorius.

The posterior Side is covered by the Skin continued from the anterior; but as the Plicæ are there very close, it only passes over them, except that Portion of the Concha which surrounds the Entry of the Meatus Auditorius, and which is connected to the Os Temporis by means of the cellular Substance. The Cavity of that common Fold which lies between the Anti-helix and Concha does not appear posteriorly; for, as it is filled with a cellular Substance, the Skin passes over it.

The Lobe of the Ear, or that soft Portion which lies under the Tragus, Anti-tragus, and Meatus Auditorius, is composed of nothing but Skin and a cellular Substance: The Meatus Auditorius is partly osseous, and partly cartilaginous: The osseous Portion is the longest, and forms the Basis of the Canal; the cartilaginous is the shortest, and, in Adults, forms the external Aperture
or

or Orifice of the Canal, as has been already described.

These two Portions, connected at the Extremity of each other, form a Canal of about three Quarters of an Inch in Length, of different Widths in its different Parts, and a little contorted: It is lined, on the internal Side, by the Skin and cellular Membrane, through its whole Length; and thus these Integuments compensate the Breaks in the cartilaginous Portion, and form a kind of cutaneous Tube in the other Portion; the cellular Membrane is confounded with the Perichondrium and Periosteum of the Meatus.

The Skin which covers both Sides of the Cartilage contains a great Number of small Glands, which continually discharge an oily whitish Humour collected chiefly near the Adhesions of the Ear to the Head, and under the Fold of the Helix; and these Glands are of the sebaceous Kind: The Skin that lines the Meatus Auditorius contains another Kind of Glands, of a yellowish Colour, which may be plainly seen on the convex Side of the cutaneous Tube already mentioned.

These Glands are disposed in such a Manner, as to leave reticular Spaces between them, and they penetrate a little way into the Substance of the Skin: They are called *GLANDULÆ CERUMINOSÆ*, because they discharge that Matter which is called Cerumen, or the Wax of the Ear. The internal Surface of the cutaneous Tube is full of fine Hairs, between which lie the Orifices of the ceruminous Glands. The first Place in which we meet with these Glands is on that Part of the convex Side of the cutaneous Tube which supplies the Breaks of the cartilaginous Meatus.

The Arteries of the external Ear come anteriorly from the Arteria Temporalis, and posteriorly from the Occipitalis, which is a Branch of

the external Carotid. It is proper to observe here, that the occipital Artery communicates with the Vertebralis, and thereby with the internal Carotid: The Veins are Rami of the Jugularis Externa; and the occipital Vein, one of these Rami communicates not only with the Vena Vertebralis, but with the adjacent lateral Sinus of the Dura Mater.

The Portio Dura of the auditory Nerve, having passed out of the Cranium through the Foramen Stylo-Mastoïdæum in a Manner as shall be afterwards described, gives off a Ramus, which ascends behind the Ear, to the posterior Part of which it sends several Filaments; and the Trunk of this Ramus sends likewise Filaments to the Meatus and anterior Side of the Ear. The second vertebral Pair sends also a Ramus to the Ear, the Ramifications of which communicate with those of the other Ramus from the Portio Dura.

I must here repeat the Advice which has been already given, to read over and retain what has been said about the osseous Parts of the Organ of Hearing in the Description of a Skeleton.

These Parts are, chiefly, the MEMBRANA TYMPANI, PERIOSTEUM of the Tympanum, OSSICULA AUDITUS, LABYRINTH, and of all its Cavities, the MEMBRANA MASTOÏDÆA INTERNA, Muscles of the Ossicula, the Parts which complete the Formation of the EUSTACHIAN TUBE, and the Arteries, Veins, and Nerves.

There is a Necessity of beginning with the TUBA EUSTACHIANA, for two Reasons. 1. Because the osseous Parts of that Tube are but of very little Use for the Knowledge of its whole Structure and Composition: And, 2. Because we are obliged to mention it in describing the Muscles.

We have taken Notice of the EUSTACHIAN TUBE, in the OSTEOGRAPHY, by the Name of
DUCTUS

DUCTUS AURIS PALATINUS; and which generally goes by the Name of the AQUEDUCT; which, however, must not be confounded with the AQUEDUCTUS FALLOPII.

We observed, that it is a Canal, or Duct, that goes from the Tympanum to the posterior Apertures of the Nares, or nasal Fossæ, and towards the Curvature of the Palate; that it is dug in the Apophysis Petrosa, along the carotid Canal; and that it is lengthened out by the spinal Apophysis of the Os Sphenoides.

In its natural State, this Duct reaches from the Cavity of the Barrel to the Radix or superior Part of the internal Ala of the Apophysis Pterygoïdes; and through this whole Course it is composed of two Portions, one entirely osseous, and the other partly so or cartilaginous, and partly membranous.

The osseous Portion lies, through its whole Length, immediately above the Fissure of the glenoid or articular Cavity of the Os Temporis, and terminates at the Meeting of the spinal Apophysis of the Os Sphenoides with the Apophysis Petrosa of the Os Temporis; that is, between that spinal Apophysis and the inferior Orifice of the carotid Canal.

The other, or mixed Portion, reaches, in the same Direction, from this Place to the internal Ala of the Apophysis Pterygoïdes, or to the posterior and external Margin of the Nares: But, to form a more exact Idea of it, it will be proper to consider it as divided into four Parts; two superior, and two inferior.

The two superior Parts, or Quarters, are osseous; and, of these, the interior is formed by the Side of the Apophysis Petrosa, the exterior by the Side of the Apophysis Spinalis of the Os Sphenoides,

noïdes, so that Half of this superior Portion of the Tube is osseous. Of the two inferior Parts, the internal is cartilaginous, and the external membranous, so that the inferior Half of this Portion of the Tube is partly cartilaginous next the Os Sphenoides, and partly membranous next the Apophysis Petrofa.

This Tube, thus formed, is very narrow in the osseous Part next the Ear; the other Portion grows gradually wider, especially near the posterior Nares, where the internal cartilaginous Side terminates by a prominent Margin, and the external joins that of the adjacent Nostril: The Cavity of the Tube is lined by a Membrane like that of the internal Vicinity of the Nares, which it appears to be a Continuation of; and; on the prominent Margin, this Membrane is considerably increased in Thickness, representing a kind of Half Pad.

This is the Tube which, by the Action of the circumjacent Muscles, may be compressed and closed; and, probably, a little relaxed, and opened again, by the circumflex Muscle of the moveable Palate. By the Canal, the inspired Air enters into the Tympanum to be changed or renewed, and the surrounding Mucus is deposited; nor is it at all improbable, that the Air enters, by the Tube, to support the Tympanum, when it is pressed internally by the more violent Sounds: For Sounds themselves, received into the Mouth, are this Way conveyed to the Organ of Hearing. In Inspiration the Air presses the Membrane of the Tympanum externally, and hence proceeds that clashing or whispering Noise by which the Hearing is obscured, when the Mouth is held wide open in Yawning: For then the Air, entering more abundantly through the Cavity of the Tube to the
Tym-

Tympanum, resists the Tremors of the external Air*.

The Situation of the two Tubes is oblique, their posterior Extremities at the Ears being at a greater Distance than the anterior at the Nares, and the convex Sides of the prominent Margins are turned towards each other. The Openings of the Tubes are oval at this Place, as is likewise their whole Cavity, especially that of the mixed Portion.

The MEMBRANA TYMPANI is a thin, transparent, flattish Pellicle, the Margin of which is circular, and strongly fixed in the orbicular Fissure that divides the osseous Meatus of the external Ear from the Tympanum: This Membrane is very tense, and yet not perfectly flat; for, on the Side next the Meatus Externus, it has a small Concavity, which is pointed in the Middle, and on the Side next the Tympanum moderately convex, and also pointed in the Middle.

It is situated obliquely, the superior Part of its Circumference being turned externally, and the inferior Part internally, suitably to the Direction of the osseous Sinus already mentioned: It is composed of several very fine Laminæ, closely connected: The external Lamina is, in some measure,

* When the glandulous Membrane of the EUSTACHIAN Tube secretes too great a Quantity of glutinous Mucus, which sometimes obstructs the Passage of the Air, and occasions Deafness, as well as the glandulous Membrane of the Ear, when it secretes too much of what is commonly called Wax.

Some Years ago a Man, at Paris, cured himself of a Deafness by syringing warm Liquors into the EUSTACHIAN Tube. Several Attempts have been made, by Surgeons, &c. which did not always prove successful. Mr. WATHEN has lately given an Account to the ROYAL SOCIETY of several Persons whom he has cured, and a Description of the Methods he made Use of, which he seems to insinuate as if he had made a new Discovery. But it appears to me, that what he says, in his Memoir, is nothing but what has long since been hinted, and practised, before him. See Memoirs and History of the Royal Academy of Arts and Sciences of Paris.

a Production of the Skin and Cuticula of the external Meatus; for they may be pulled, at the same Time, like the Finger of a Glove; the internal Lamina is a Continuation of the Periosteum of the Tympanum; and, when the Membrane has been first macerated in Water, each of these Laminæ may be subdivided into several others, which sometimes amount to six. In Infants this Membrane is covered externally by a thick mucilaginous Web.

The Depression in the Middle of the Membrana Tympani is caused by the Adhesion of the little Bone called Malleus, the Handle of which is closely connected to the internal Side of the Membrane from the superior Part of the Circumference all the way to the Center, to which the Extremity of the Malleus is fixed. This Malleus seems to lie in a very fine membranous Duplitecture, by means of which it is tied to the Membrana Tympani, and which serves it for a Periosteum.

The PERIOSTEUM of the Tympanum of the Ear, produces that of the small Bones, and may be made visible by means of anatomical Injections, which discover capillary Vessels very distinctly ramified on the Surface of the Ossicula: It is likewise continued over the two Fenestræ, and enters the EUSTACHIAN Tube, where it is lost in the interior Membrane of that Duct.

The CELLULÆ MASTOÏDÆI are very irregular Cavities, in the Substance of the mastoid Apophysis, which communicate with each other, and have a common Opening towards the internal Side, a little above the posterior Margin of the orbicular Sinus: These Cells are lined by a fine Membrane, which is partly a Continuation of the Periosteum of the Tympanum, and seems partly to be of a glandular Structure, like a kind of Membrana
Pi-

Pituitaria. The mastoid Opening is opposite to the small one of the EUSTACHIAN Tube, but a little higher.

The Ligaments of the OSSICULA come next in Order, to understand which, we shall suppose the Reader acquainted with what we said concerning these small Bones in our OSTEOGRAPHY. The Incus is tied, by a strong short Ligament fixed in the Point of the short Leg, to the Margin of the mastoid Opening; between the Incus and Malleus we find a small thin Cartilage; the Malleus is connected, through the whole Length of its Handle, to the interior Side of the Membrana Tympani, in the Manner already said. We need only add here, that, by Help of a Microscope, we discover round the Point of the Malleus, in the Substance of the Membrane, a small orbicular Plane of a whitish Colour, a little inclined to red.

The Malleus has three Muscles; one external, one anterior, and one internal: And the Stapes has one Muscle. The external or superior Muscle of the Malleus, attributed to CASSERIUS, and mentioned by FABRICIUS AB AQUAPENDENTE, is a thin Fasciculus of muscular Fibres lying along the superior Part of the osseous Meatus Auditorius, between the Periosteum and the other Teguments: The external Part of it is pretty broad, and it contracts, by Degrees, as it advances towards the superior Part or Break of the orbicular Sinus of the Tympanum, into which it enters, by a small Tendon, above the Membrana Tympani, and is inserted, in the Cervix of the Malleus, near the small Eminence, or short Apophysis, of the Handle. This Muscle is sometimes so pale, as hardly to be distinguished.

The anterior Muscle of the Malleus, called by DUVERNAY the external, is muscular, long, and thin: It runs along the external Side of the Eu-

STACHIAN Tube, to which it adheres very closely through its whole Length; its anterior Extremity is fixed, in that Side of the Tube, just before the sphenoid Spine; and the posterior ends in a long thin Tendon, which runs in the articular or glenoid Fissure of the Os Temporis, through a small oblique Fissure, in which it enters the Tympanum, and is inserted in the long thin Apophysis of the Malleus. It is partly accompanied by a Nerve, which forms what is called the Chorda Tympani.

The internal Muscle is very muscular and distinct: It lies along the internal Side of the EUSTACHIAN Tube, partly on the cartilaginous, and partly on the osseous Portion; being fixed, by one Extremity, in the Apophysis Petrosa; afterwards it runs along the Cavity of the osseous Semi-canal of the Tympanum, within which Cavity it is invested by a Portion of a membranous or ligamentary Vagina, which, being fixed to the Margins of the Semi-canal, forms an entire Tube therewith; and this Vagina must be cut open before we can see the Muscle. The Malleus returns the Tremor, impressed on the Membrane of the Tympanum, to the Incus.

At the Extremity of this osseous Semi-canal, where is observed the Cavity shaped like the Mouth of a Spoon, this Muscle ends in a Tendon, which is bent round the transverse osseous or ligamentary Ridge in the last named Cavity, as over a Pulley, and is inserted in the Cervix of the Malleus above the small Apophysis, advancing, likewise, as far as the Handle: The Extremities of the anterior and internal Muscles sometimes meet, and there they cover the mixed Portion of the EUSTACHIAN Tube.

The Muscle of the Stapes is short and thick, and lies concealed within the small osseous Pyramid at the Basis of the Tympanum: The Cavity
which

which it fills, touches, very nearly, the osseous Canal of the Portio Dura of the auditory Nerve; and it terminates in a small Tendon that egresses from the Cavity through the small Aperture in the Apex of the Pyramid: As it passes through the Aperture it turns anteriorly, and is inserted, in the Cervix of the Stapes, on the Side of the longest and most crooked Leg of that Bone.

The three Parts of the LABYRINTH, that is, the Vestibulum, semi circular Canals, and Cochlea, are lined by a fine Periosteum, which is continued over all the Sides of their Cavities, and shuts the two Fenestræ of the Tympanum.

In all the Subjects which I ever examined, I have found the semi-circular Canals simply lined by a Periosteum adhering to their internal Surfaces, without any particular membranous Bands. The two Semi-canals of the Cochlea are lined in this Manner: The Periosteum of the two Sides of the osseous spiral Lamina advances beyond the Margin of that Lamina, and forms a membranous Duplication, which, extending to the opposite Side, completes the spiral Septum.

This Septum separates the two Semi-canals from the Basis to the Apex, but there it leaves a small Aperture, by which the small Extremities of the Semi-canals communicate with each other; the large Extremity of the external Semi-canal terminates, by an oblique Turn, in the Fenestra Rotunda, which is shut by a Continuation of the Periosteum of that Canal; the large Extremity of the other Semi-canal opens into the Vestibulum; and these two Extremities are entirely separated by a Continuation of the Periosteum.

All the Periosteum of the internal Ear, especially that of the Ossicula and Tympanum, is, in Children, no more than a Mucilage; and in them,
like-

likewise, the Membrana Tympani is thick, opaque, and covered with a whitish slimy Matter.

Through the whole Extent of the Periosteum of the internal Ear, especially on that of the Officula, semi-circular Canals, and Half-canals of the Cochlea, are discovered a vast Number of sanguineous Vessels, not only by anatomical Injections, but in Inflammations, and even without the Help of a Microscope: For they have been visible to the naked Eye in the semi-circular Canals and Half Canals of the Cochlea. The Arteries come partly from the internal Carotid, and partly from the Arteria Basilaris, which is a Continuation of the Vertebralis, the small capillary Ramifications of which may be observed to accompany the auditory Nerve through the internal Foramen Auditorium.

The Portio Mollis of the auditory Nerve terminates, by its Trunk, at the great Fossula of the internal auditory Foramen, from whence the Filaments pass, thro' several small Foramen in the Basis of the Cochlea, partly to the Periosteum of the semi-circular Canals, and partly to the internal Periosteum of the Half Canals of the Cochlea.

The Portio Dura, which I name Nervus Sympatheticus Minor, runs first into the small Fossula of the Foramen Auditorium Internum, then passes through the whole osseous Duct called Aqueductus FALLOPII, and egresses through the Stylo-Mastoid Aperture of the Os Temporis: In this Course it communicates with the Dura Mater on the superior or anterior Side of the Apophysis Petrosa, at the Place where the osseous Duct is interrupted, as was mentioned in the Description of the Skeleton.

Having reached behind the small Pyramid at the Basis of the Tympanum, this Nerve sends a small

small Filament to the Muscle of the Stapes; and, a little before it egresses by the Stylo-Mastoid Foramen, it gives off another more considerable Filament that enters the Tympanum from behind anteriorly, passes between the long Leg of the Incus and Handle of the Malleus, and afterwards runs cross the whole Breadth of the Tympanum a little obliquely, and egresses at the same Place where the Tendon of the anterior Muscle of the Malleus enters.

This small Nerve is generally called Chorda Tympani, because, in its Passage thro' the Tympanum, it has been compared to the Cord of a Drum: Having left the Cavity of the internal Ear, it advances towards one Side of the Basis of the Tongue; where, having joined the small Nervus Lingualis, it is considered as a kind of Recurrent; but the remaining Part of its Course must be referred to the Description of the Tongue.

The Portio Dura of the auditory Nerve, having passed through the Foramen Stylo-Mastoidæum, is distributed, in a Manner as shall be mentioned in the Description of the Nerves; and we ought very carefully to observe its different Communications with the Branches and Rami of the Nerves of the fifth Pair, the Sympatheticus Medius or eighth Pair, the second Pair of cervical Nerves, and with the Nervi Sub-Occipitales, or tenth Pair of the Medulla Oblongata, &c.

With respect to the Nerves which are distributed through the Vestibulum, and seem semi-circular Canals, there is no Doubt but it is struck with the Tremors of the external Air, propagated to the Stapes; whence those Tremors immediately pass through the oval Fenestra, to press upon the naked Pulp of the Nerve: That of the Nerve which enters the Cochlea is altogether obscure in its Termination, tho' it is probable that small Branches
from

from thence pass through the little Foramina to the Periosteum of the Cochlea, and to the membranous Part of the spiral Partition. Whether or no the transverse nervous Filaments pass out from the Nucleus of the Cochlea, all the Way successively shorter through the spiral Lamina? And whether, by this Mechanism, it becomes the Organ of Hearing? are curious Questions, which we are yet hardly able to resolve from Anatomy; tho' this seems repugnant to the Course that we observe Nature takes in Animals, Birds, and Fishes, which all hear very exquisitely, without any Cochlea.

However this may be in the human Body, it is there probable, that the spiral Lamina, spread full of Nerves, is agitated with Tremors from the Oscillations of the Membranes of the Tympanum, by which the Air in the Cavity of the Tympanum is agitated, to press the Membrane of the round Fenestra, which again agitates the Air contained in the Cochlea.

The preceding Conjecture is indeed elegant, as the spiral Laminæ, composed of a Triangle ending in a short Point towards the Apex, by which it may be conceived to contain an infinite Number of nervous Rami, continually shortening in their Length; and, by that means, adapt an harmonical Unison, or Consonance, according to the Variety of acute and grave Sounds, so as to vibrate together at the same Time with most of them; namely, the longest Branches in the Basis of the Cochlea with grave Sounds; and the shortest Branches, nearer the Apex, with sharper Sounds.

Whether Sounds are perceived in the middle semi-circular Canal, which yet are said to be absent in the Elephant?

The Ear is the Organ of which we can most distinctly extricate the Structure, and demonstrate
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the greatest Number of Parts ; that is, of small Machines which it is composed of ; We know likewise, in general, that it is the Organ of Hearing ; but when we endeavour to discover the Uses of each of these Parts, that is, how each contributes to the great Design of the Whole, after having thoroughly examined them, we must be obliged to own, that the greatest Part of what the most able Philosophers have said upon this Subject, is without any real Foundation.

It is certain, that the Cavity of the external Ear collects Sounds, or Noise, and centers them towards the Bottom of the Concha, all the Way to the external Meatus Auditorius. This we learn from Experience, by enlarging this Cavity with the Hand : It may likewise be affirmed, with Certainty, that, in Proportion as the Membrana Tympani is more or less stretched, Sounds become more or less sensible. This Experience teaches us. For when this Membrane is wetted by any Liquor, our Hearing is imperfect, but is restored again when the Membrane is dry. By the Muscles of the Ossicula we can demonstrate, that this Membrane is capable of being stretched and relaxed, as Occasion requires ; but the Prosecution of this curious Subject must be referred to another Treatise, for this Purpose.

Into this described cartilaginous Funnel of the Ear the sonorous Waves of the Air flow, which, from Principles of Mechanicks, it must, of course, collect. The elastic Air, only, receives sonorous Tremors, or Impulsions, and transfers them, either alone, or principally, much after the same Manner as we see Water, without Air, transfer any Impulse that is given to it : Hence the Sound is increased in the Air, that is, condensed, and lost in a Vessel emptied of its Air. But the Medium receives these Tremors either from some Substance striking

striking against it, or from the Air itself colliding against another Body, or, lastly, from the Collision of two Bodies against each other in the Air; and the Substance, which produces Sound, ought to tremble or vibrate in all, even the least of its Particles: From such a Tremor the contiguous Air is beat into Waves, whereby the Parts of it, that lie exterior, are compressed, and fly back again, as soon as their Elasticity overcomes the Impulse; whence the Air flies again towards the sonorous Body, where it is now more loose and rarefied, to be there again compressed by Impulsion; and, in the same Manner, the anterior and exterior Portion of Air, surrounding that which is impelled, is, by the Action of the latter, compressed, and removed farther from the trembling Body, yet so as to return again, in its proper Time, by the tremulous Body, for the exciting of a new Wave. These Oscillations, or Impulsions, of the Air, are required to succeed each other with a certain Velocity; and, in order to render them audible, they must not be fewer than Thirty in a Second of Time: But as these sonorous Waves are more frequent, in a given Time, so much sharper is the Sound heard, and the more strongly does it affect us, till we come to the most acute of audible Sounds, which have 7520 Tremors in a Second.

Acute Sounds are, in general, yielded from Bodies that are hard, friable, and violently shook, or struck; but grave Sounds are from the contrary. As to any Medium between acute and grave Sounds, there is none but what is arbitrary. Chords, or other Bodies, that yield the same Number of Vibrations in a given Time, are said to be Unisons; as those, which make double the Number of Oscillations in that Time, are said to yield a Tone that is an Octave, or eight Notes higher; and other Proportions between the Numbers of the

the Vibrations have different Names assigned to them, in a musical Scale.

The shorter Chords produce sharper Tones, and the reverse, in a Proportion directly as their Lengths; as those, which are more stretched, afford sharper Sounds in a subduplicate Proportion of their Tensity, or to the Weights, or Powers, by which they are stretched; as one may easily perceive, by Experiment, either in a Violin, or Monochord.

The Sound, thus produced, whether acute or grave, strong or weak, is carried thro' the Air with a Celerity equal to about 1038 Paris Feet in a Second, and that with a uniform Velocity, without abating in the longer Distances: But a contrary Wind, causing the Vibrations to extend more slowly, retards the Progression of the Sound about one Twelfth of its Velocity. So, likewise, Density and Driness of the Air increase the Sound; as a Rarefaction and Moisture lessen it: Hence, in Summer-time, Sounds move swifter. And, in Guinea, it has been observed to pass at the Rate of 1378 Parisian Feet in a Second of Time.

Sound, thus every Way extended, meets with certain Particles in all adjacent Bodies, even Water and Mercury, to which it communicates similar Tremors, or Vibrations; not only such as are in Unison with the original Tone, and which yield a Sound, in a more particular Manner, sensible; but, also, it excites Tremors less sensible, even in the various Proportions of a Music Scale. Hence it is, that every Sound, which we hear, is a Mixture of the original Tone produced by a trembling Body, in Conjunction with secondary Tones generated from the elastic Tremors of the surrounding Bodies.

The Strength of Sound is increased, if one audible or primary Tone follows the other so closely, that

that their Succession cannot be distinguished by the Ear; but if they follow each other so slowly as to be distinguishable by the Ear, they produce an Echo: But, to produce this, requires an Interval of six Parts of a Second of Time, or the Distance of 110 Feet, between the reflecting or echoing Body and the Ear.

Sounds, being elastic, are reflected from hard Bodies in Angles equal to those of their Incidence: But the same Sound, ushered into the open Air, and dilating through an immense Sphere, grows proportionably weaker; but, if it be propagated through a Tube, of a cylindrical Shape, the Strength of it is more confined together; or else, by being collected in the Focus of a Parabola, or Ellipsis, it becomes increased, as we observe in Speaking Trumpets; from which the Voice goes out parallel to the Focus of the Parabola, without scattering the sonorous Rays.

Therefore the sonorous Waves of the elastic Air, being driven into the cartilaginous Funnel of the Ear, which is naturally inclined anteriorly and externally in a high Situation, are repelled and collected, by alternate Reflexions from its elastic Sides, into the Cavity of the Concha, from whence it proceeds through the auditory Passage with a Force so much stronger, as the Surface of the external Ear is larger than the Light or Section of the said auditory Passage; through which, however cylindrical, the same Force is continued entirely forwards, and increased by new Resonances excited from the Percussion of the elastic Cartilages and hard Bones, so as to mix imperceptibly with the primitive Sound.

From what has been said, it appears, that the elastic Waves or Tremors of the Air arrive thro' the external Ear and auditory Passage to the Membrane of the Tympanum, and from thence the
Tremors

Tremors are more accurately conveyed thro' the small Bones, two Ways; to the Vestibulum, but in a more confused uncertain Manner thro' the Air of the Tympanum to the round Fenestra and Cochlea.

Of more than this we are not certain: But, by undoubted Experiments, Tremors, and even elastic Sounds, communicate themselves by the internal EUSTACHIAN Tube, and through all the Bones of the Cranium, so as to impress their Force upon the auditory Nerve.

The Distinction of Sounds, as to Acuteness and Gravity, doubtless, proceeds from the Celerity of the Tremors excited in the auditory Nerve, according as they succeed each other more swiftly or slowly, in a short Time; in order to which, it is not necessary the Mind should number them: It is sufficient that she perceives their Numbers to be different, and that this Difference excites a Variation in her Thoughts, and Ideas thence arising.

Whether the Harmony or Agreeableness of Sounds arises from the Number of Parts sounding together in Unison; and whether the Mind, ignorant of herself, numbers the Degrees of Consonance, so as to please herself in a Majority of them? These are Questions denied by the most expert Musicians; who make it appear, that there is an Agreeableness, and that very considerable, in Sounds approaching the least to, and which lies in, a Proportion very difficult to determine.

Why Sounds become too sharp for the Ear? Our auditory Nerves seem to be strained upon the spiral Lamellæ in such a Degree, as to be in Danger of breaking, after the Manner that drinking Glasses may be broke by sharp Sounds; and as the Hearing is sometimes almost lost, for a while, by the violently shrill Whistlings of the Inhabitants of the Canary Islands. HALLER. Prim. Lin.

OBSERVATIONS.

It is to be observed, that, on account of the Communication of the third Branch of the fifth Pair of Nerves with the hard Portion of the seventh, and, at the Time of the Distribution of this third Branch of the fifth Pair to the Tongue, some have pretended to explain the Cause why Persons born deaf, are also, consequently, dumb.

However, it is true, that, among these Persons born deaf, there are some who are only dumb at the same Time by the Alteration of these Nerves; we may also readily conceive, that there are many who are dumb because not hearing any Sounds; therefore incapable of learning any Language. In a Word, it is to be observed, that there is a particular Manner of teaching them to speak, according to Dr. AMMAN, who taught several Persons in Holland, who were born deaf and dumb. See his Treatise *Surdus Loquens sive Disfertatio de Loquela*, &c.

Professor WINSLOW says, that he has often conversed with a Lady of Haarlem, born deaf and dumb, whom Dr. AMMAN had not only taught her native Language, but also Latin and French.

It is to be supposed, that these Persons can only hold a Conversation by carefully observing the different Motions of the Lips of those who speak to them.

We are to take Notice, that the Wax which is collected in the Ear is bitter and viscous, consequently abounds with acrid and lixivious Salts, which are mixed with thick and oleaginous Particles; these Principles give it very near the same Qualities that are attributed to the Bile, which it very much resembles. If it happens, by any means whatsoever, that these saline Juices disengage and expand themselves, and that, being
more

more exalted than usual, their Pungency acts with more Violence; it is evident, that they must cause great Disorders in the auditory Passage, because of its extreme Sensibility. Cold and Heat are commonly the Causes of it: For Cold, thickening this Wax, and rendering it more viscous, causes it to obstruct the excretory Ducts of the Glands; but, if the Wax be secreted in too great a Quantity, and growing thick, will, at last, be a means of obstructing the Undulations of the Air from affecting the Membrana Tympani; as, by Experience, has been found in the Ears of Persons who were afflicted with Deafness for many Years; the auditory Passages, about two Lines from the Membrana Tympani, a small Bellet, which was soft, and pretty thick, with a considerable Quantity of Filth indurated, collected before it; and I do not doubt but that a great many Deafnesses are occasioned by the same Means.

But the Ear Wax is not the only Cause of these acute and violent Pains; it very often happens, that those sharp, saline, serous Humours, which are evacuated by the Glands of the Ear, cause Pain in the auditory Passage, which is apparent in the Suppuration of this Part. For as these serous Humours, which are emitted, are sometimes acrimonious, or saline, they stimulate the Membrane of the Passage, and excite an uneasy Sensation, which is what we call Pain.



LECTURE V.

Of the Organs of SIGHT.



THE Organ of HEARING distinguishes the Tremors of the Air; so does that of SIGHT perceive those of Light: And as the first consists chiefly of osseous Organs, capable of making a Resonance; here, on the contrary, the greater Part of the EYE is composed of pellucid Humours capable of refracting the more subtil Medium of Light. But the Complexity of this Organ was necessary, for the Defence of its tender Parts, and for the Diversity of the several Humours to be contained each in their proper Integuments.

The EYES are commonly two in Number, situated at the inferior Part of the Forehead, one on each Side of the Radix of the Nose; and are composed of hard and soft Parts.

The hard Parts are the Bones of the Cranium and Face, which form two pyramidal or conical Cavities, like Funnels, which are named ORBITS. The soft Parts are of several Kinds.

The principal and most essential soft Part in each Organ is the Globe of the Eye; the others are partly external, and partly internal.

The external Parts are, the SUPERCILIA, or EYE BROWS, PALPEBRÆ, or EYE LIDS, CARUNCULA LACRYMALIS, and PUNCTA LACRYMALIA; the

the internal Parts are, the Muscles, Fat, LACRYMAL GLAND, Nerves, and sanguineous Vessels.

All the Cavity of the Orbit is lined by a Membrane, which is an Elongation or Production of the Dura Mater; and it comes partly through the Foramen Opticum of the Os Sphenoïdes, and partly through the sphenoid or superior orbitaly Fissure. This Membrane, which may be looked upon as the Periosteum of the Orbit, communicates with the Periosteum of the Basis Cranii by the inferior orbitaly Fissure, and with the Periosteum of the Face at the Margin of the Orbit. At the superior Part of the Margin of the Orbits the two Periosteæ form a kind of broad Ligament, and a narrow one at the inferior Part of this Margin, which are called Ligaments of the Palpebræ.

The particular Situation of the Orbits represents, nearly, two Funnels, placed laterally at a small Distance from each other, in such a Manner, that their Apices are almost joined, their nearest Sides almost parallel, and the other Sides turned posteriorly oblique; and, for this Reason, the Middle of the great Circumference or Margin of the Orbit is at a much greater Distance from the Septum Narium than the Basis or Apex; and the Margin or great Circumference is very oblique, the temporal or external Angle of the Orbit lying more posterior than the nasal or internal Angle.

The PALPEBRÆ, or EYELIDS, are a kind of Veils, or Curtains, placed transversely above and below the anterior Portion of the Globe of the Eye; and, accordingly, there are two to each Eye, one superior, the other inferior.

The superior is the largest, and most moveable, in Man; the inferior the smallest, and least moveable: They both unite at each Side of the Globe, and the Places of their Union are named Angles; one large, and internal, which is next the Nose;

the other small, or external, which is next the Temples.

The Palpebræ are composed of common and proper Parts. The common Parts are, the Skin, Epidermis, and Membrana Adiposa; the proper Parts are, the Muscles, Tarfi, Puncta, or Foramina Lacrymalia, Membrana Conjunctiva, Glandula Lacrymalis, and the particular Ligaments which sustain the Tarfi. The Tarfi and their Ligaments are, in some measure, the Basis of all these Parts.

The TARSI are thin Cartilages forming the principal Part of the Margin of each Palpebra, and are broader in the Middle than at the Extremities. Those of the superior Palpebræ are somewhat less than Half an Inch in Breadth, but in the inferior Palpebræ they are not above the sixth Part of an Inch; and their Extremities next the Temples are more slender than those next the Nose.

These Cartilages are suited to the Borders and Curvature of the Eye Lids. The inferior Margin of the superior Cartilage, and the superior Margin of the inferior, terminate equally; and both may be termed the ciliary Margin. The opposite Margin of the superior Tarsus is somewhat semi-circular between its two Extremities, but that of the inferior is more uniform, and both are thinner than the ciliary Margins. Their internal Sides, or those next the Globe, are sulcited by several small transverse Canals; and the Extremities of both Cartilages are connected by a kind of small Ligaments.

The broad Ligaments of the Tarfi are membranous Elongations formed by the Union of the Periosteum of the Orbits and Pericranium along both Margins of each Orbit. The superior Ligament is broader than the inferior, and fixed to the

the superior Margin of the superior Cartilage as the inferior is to the inferior of the lower Cartilage; so that these Ligaments and the Tarfi, taken alone, or without the other Parts, represent Palpebræ. This Discovery WINSLOW first communicated in his private Courses.

The MEMBRANA CONJUNCTIVA is generally described among the Tunics of the Globe of the Eye; and it is also mentioned there, but the Description of it is referred to that of the Palpebræ. It is a thin Membrane, one Portion of which lines the internal Surface of the Palpebræ, that is, of the Tarfi and their broad Ligaments: At the Margin of the Orbit it has a Plica, and is continued from hence on the anterior Half of the Globe adhering to the Tunica Albuginea; so that the Palpebræ and the anterior Part of the Globe of the Eye are covered by one and the same Membrane, which does not appear to be a Continuation of the Pericranium, but has some Connexion with the broad Ligaments of the Tarfi.

The Name of Conjunctiva is commonly given only to that Part which covers the Globe, the other being called simply the internal Membrane of the Palpebræ: But we may very well name the one Membrana Oculi Conjunctiva, and the other Membrana Palpebrarum Conjunctiva. That of the Palpebræ is a very fine Membrane adhering very close, and full of small capillary sanguineous Vessels: It is perforated by numerous imperceptible Pores, thro' which a kind of Serum is continually discharged; and it has several very evident Plicæ.

The Conjunctiva of the Eye adheres by the Intervention of a cellular Substance, and is, consequently, loose, and, as it were, moveable; and it may be taken hold of, and separated, in several Places, from the tendinous Tunic. It is of a

whitish Colour, and, being transparent, the Albuginea makes it appear perfectly white; these two Tunics, together, forming what is called the White of the Eye. The greatest Part of the numerous Vessels which run upon it contain naturally only the serous Part of the Blood, and, consequently, are not visible, except by anatomical Injections, Inflammations, Obstructions, &c. With the Point of an acute Knife the Separation of this Membrane may be continued over the Cornea Lucida.

The LACRYMAL GLAND is whitish, and one of the Number of those called conglomerated: It lies under that Depression observable in the Curvature of the Orbit near the Temples, and laterally above the Globe of the Eye. It is a little flattened, and divided, as it were, into two Lobes; one of which lies towards the Insertion of the Musculus Rectus Superior, the other towards the Rectus Externus. It adheres very closely to the Fat that surrounds the Muscle and posterior Convexity of the Eye, and was formerly named Glandula Innominata, not knowing its Office then.

From this Gland several small Ducts egress which descend, almost parallel to each other, thro' the Substance of the Tunica Interna, or Conjunctiva of the superior Palpebra, and afterwards pierce it internally near the superior Margin of the Tarsus. (These Ducts are very difficult to be found; and the best Way to discover them is, to let the superior Palpebra lie for a little while in cold Water, and then, without wiping it, to blow on several Places of the Surface of the Membrane through a small Tube held very near, but so as not to touch it, that the Air may fill some of the Orifices of the Ducts, and so discover them.)

The Borders of each Palpebra, taken all together, are formed by the Margin of the Tarsus, and by the Union of the internal Membrane with
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the Skin and Epidermis : This Border is flat, and of some sensible Breadth from within about a Quarter of an Inch of the internal Angle all the way to the external Angle, near which the Breadth diminishes. This Breadth is owing only to the Thickness of the Palpebræ, which at this Place have their Margins oblique or slanting, in such a Manner, as, when the two Palpebræ touch each other slightly, a triangular Space or Canal is formed between them and the Globe of the Eye.

The flat Margin of each Palpebra is adorned with a Row of Hairs called CILIA, or Eye Lashes. Those belonging to the superior Palpebra are bent superiorly, and longer than those of the inferior Palpebra, which are bent inferiorly; these Rows are placed next the Skin, and are not single, but irregularly double or triple : The Hairs are longer near the Middle of the Palpebræ than towards the Extremities, and, for about a Quarter of an Inch from the internal Angle, they are absent.

Along the same Border of the Palpebræ, near the internal Membrane, or towards the Eye, is seen a Row of small Foramina, which may be named Foramina, or Puncta Ciliaria : They are the Orifices of the same Number of small oblong Glands that lie, in the Sulci Canals, on the internal Surface of the Tarsus. These little Glands are of a whitish Colour, and, when examined thro' a single Microscope, appear like Bunches of Grapes, those of each Bunch communicating with each other; and, when they are squeezed between two Nails, a sebaceous Matter, like soft Wax, is ouzed thro' the Puncta Ciliaria.

Near the great or internal Angle of the Palpebræ the flat Portion of their Margins terminates in another that is rounder and thinner : By the Union of these two Margins an Angle is formed, that

that is not perfectly pointed like a true Angle, but rounded, and yet it ought not to be termed an obtuse Angle, because that Expression, in a mathematical Stile, means something different. For the same Reason, the Name of great Angle is improper; and we had better call it the internal or nasal Angle.

At this Place the Extremity of the flat Portion is distinguished from the round Portion by a small Protuberance or Papilla, which is obliquely perforated by a small Foramen in the Margin of each Palpebra: These two small Foramina are very visible, and often more so in living than dead Bodies, and are commonly named *Puncta Lacrymalia*; being the Orifices of two small Ducts that open, beyond the Angle of the Eye, into a particular Reservoir named *Sacculus Lacrymalis*.

The *PUNCTA LACRYMALIA* are opposite to each other, and so they meet when the Eye is shut. Round the Orifice of each of these Points we observe a whitish Circle that seems to be a cartilaginous Appendix of the Tarsus, and which keeps the Orifice always open: These two oblique Circles are so disposed, that, when the Eye is but slightly shut, they touch each other only towards the Skin, and not towards the Globe of the Eye. The fine Membrane that covers these Circles, and passes thro' the *Puncta* into the Ducts, seems sometimes to run into Collections when it is touched with a Stilet. This Observation was first made by the late M. SAINT YVES, a Parisian Oculist.

The *CARUNCULA LACRYMALIS* is a small reddish, granulated, oblong Body, situated precisely between the internal Angle of the Palpebræ and Globe of the Eye, but it is not musculous, as its Name seems to imply. The Substance of it appears to be wholly glandular; and it appears, thro' a single Microscope, in the same Manner as the
other

other conglomerate Glands. We discover upon it a great Number of fine Hairs covered by an oleaginous yellowish Matter; and on the Globe of the Eye, near this glandular Body, we see a semilunar Plica, formed by the Conjunctiva, the concave Side of which is turned to the Uvea, and the convex to the Nose. This Plica appears most when the Eye is turned towards the Nose.

That the Palpebra, rubbing against each other, might not coagulate, they are supplied with a Row of about thirty sebaceous Glands, according to the Length of the Eye Lid, without ever branching, but composed of peculiar blind Sinuses, which end, at last, in one large serpentine Duct, opening, by an Orifice, in the Margin of the Eyelid itself. These discharge a soft Liment, which mixes and washes off with the Tears.

The perpetual Attrition of the Eyelids ascending and descending against the Globe of the Eye, is prevented by the distilling Humour named Tears, which also preserve the Tenderness of the Membranes, and of the Cornea, and serve to wash away any extraneous Corpuscles: These form a saline pellucid Liquor, that may be evaporated, and never ceases to be poured over the anterior Surface of the Eye, yet never runs over the Cheeks, unless collected in too great a Quantity, or the Parts be too much compressed by the circumjacent; as Laughing, Crying, irritated, &c. This Liquor is exhaled partly from the Extremities of the Arteries of the Conjunctiva, as we see in imitating Nature by injecting Water; and it is partly thought to proceed from a Gland seated in a Recess of the Orbit of the Os Frontis, somewhat hard, and of the conglomerate Kind, intermixed with Fat, and furnished with many sanguineous Vessels from the Ophthalmics and internal max-

maxillary Arteries, and interspersed with many small Nerves*.

After the Tears have performed their Office, some Part of them evaporating, the rest, that they might not offend by too great a Quantity, are propelled, by the orbicular Muscle towards its Origination next to the Nose, to a Part which is the inferior of the palpebral Margins; which, not being surrounded by the Tarsus, do not therefore meet exactly together. In this Place lies a Caruncle full of sebaceous hairy Follicles, of an oblong Figure, which interposes, and separates the meeting of the Eyelids, furnishing, likewise, an Uction to those Parts which have none of the Meibomean Ducts. Before this Part is extended, a small Portion, like a little Eyelid, which, descending perpendicularly, joins the true Eyelids; but, at the Beginning of this Space between the Eyelids, in which the Tears are collected, both in the superior and inferior Margins, two small Papillæ project, having each of them an Aperture, surrounded by callous Flesh, which are perpetually open, unless when convulsively closed: This Opening, which is called the *Puncta Lacrymale*, absorbs the Tears from the Sinus partly by a tubular Attraction, and partly by Impulsion, from the orbicular Muscle. When these Apertures are obstructed, the Tears run on the Cheeks. From these Openings proceeds a small Duct, both from the superior and inferior Eyelid, much wider than the Apertures themselves, but thin, and included in the Skin which covers the Caruncle; whence, going transversely, they connect, and are

* From this lacrymal Glandule, in horned Cattle, descend three, four, or more, visible Ducts, which open, on the interior Side of the Conjunctiva, upon the Eyelids; but, in the human Species, we are not sufficiently certain of these Ducts,

inserted, by two Orifices, near the superior Part of the lacrymal Bag. Thus a Cavity is formed, in the Os Unguis and superior Maxilla, lined with a Membrane which is, at first, ligamentary, and of an oval Figure: From the same Sacculus is continued a Duct, which descends a little posteriorly into the Nares, opening there by an oblique and oblong Aperture at the Basis of the Meatus, covered by the inferior Os Spongiosum. Thro' this Passage the superfluous Tears descend into the Nose, which they partly moisten. Some Authors ascribed a Muscle to this Sacculus; but we are not yet certain of it.

The Muscles of the Palpebræ are commonly reckoned to be two: One, peculiar to the superior Eyelid, named Levator Palpebræ Superioris; the other, common to both, called Musculus Orbicularis Palpebrarum, which has been subdivided in different Manners, as we have described amongst the Muscles of the Face.

The LEVATOR PALPEBRÆ SUPERIORIS is a very thin Muscle, situated in the Orbit above and along the Rectus Superior Oculi: It is fixed to the Basis of the Orbit, by a small narrow Tendon, near the Foramen Opticum, between the posterior Insertions of the Rectus Superior and Obliquus Superior; from thence its muscular Fibres run anteriorly on the Rectus, increasing gradually in Breadth, and terminate, by a very broad Aponeurosis, in the Tarsus of the superior Palpebra.

THE TUNICA ALBUGINEA AND MUSCLES OF THE GLOBE OF THE EYE.

The TUNICA ALBUGINEA, commonly called the White of the Eye, and which appears on all the anterior convex Side of the Globe, from the Cornea Lucida to the Beginning of the posterior
Side,

Side, is formed chiefly by the tendinous Expansion of four Muscles, in the Manner presently to be described: This Expansion adheres very closely to the Sclerotica, and makes it appear very white and shining, whereas the rest of it is of a dull whitish Colour. It is very thin near the Margin of the Cornea, in which it seems to be lost, terminating very uniformly.

There are commonly six Muscles inserted in the Globe of the human Eye; and they are divided, on account of their Direction, into four Recti, and two Obliqui. The Recti are again divided, from their Situation, into superior, inferior, internal, and external; and, from their Functions, into a Levator, Depressor, Adductor, and Abductor. The two oblique Muscles are denominated from their Situation and Size; one being named Obliquus Superior, or Major; the other Obliquus Inferior, or Minor. The Obliquus Major is likewise called Trochlearis, because it passes through a small cartilaginous Ring, as over a Trochlea, or Pulley.

MUSCULI RECTI do not altogether answer to that Name; for, in their natural Situation, they do not all lie in a strait Direction, as they are commonly represented in an Eye taken out of the Body. To understand this, we ought to have a just Idea of the Situation of the Globe in the Orbit; and, at the same Time, to remember the Obliquity of the Orbits, as already explained. The Globe is naturally placed in such a Manner, as that, during the Inaction or Equilibrium of all the Muscles, the Pupilla is turned directly forward; the internal Margin of the Orbit is opposite to the Middle of the internal Surface of the Globe; the external Margin of the Orbit, because of its Obliquity, is behind the Middle of the external Side of the Globe; and, lastly, the greatest

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Cir-

Circumference of the Convexity of the Globe, between the Pupilla and the Optic Nerve, runs directly inward and outward, superiorly and inferiorly.

In this Situation, the internal Rectus alone is in a strait Direction, the other three being oblique; and the external Rectus is the longest, the internal the shortest, and the superior and inferior of the same middle Length between the two former. The external Rectus is likewise bent round the external convex Side of the Globe; the superior and inferior are also incurvated, but in a less Degree; whereas the whole Internus is almost strait. Notwithstanding all this, we shall still continue to give to them all the common Name of Musculi Oculi Recti.

These Muscles are fixed, by their posterior Extremities, at the Bottom of the Orbit, near the Foramen Opticum, in the Elongation of the Dura Mater, by short narrow Tendons, in the same Order in which we have already named them: From thence they run, wholly muscular, towards the great Circumference of the Convexity of the Globe between the Optic Nerve and Cornea Lucida, where they are expanded into flat broad Tendons which touch each other, and afterwards unite. These Tendons are fixed, first of all, by a particular Insertion, in the Circumference just mentioned, and afterwards continue their Adhesion all the way to the Cornea, forming the Tunica Albuginea, as has been already said.

The OBLIQUUS SUPERIOR is fixed to the Bottom of the Orbit by a narrow Tendon, in the same Manner as the Recti, between the Rectus Superior and Internus; from thence it runs on the Orbit, opposite to the Interstice between these two Muscles, towards the internal angular Apophysis of the Os Frontis, where it terminates in a thin Tendon;

Tendon ; which having passed, through a kind of Ring, as over the Trochlea, runs afterwards in a Vagina, posteriorly oblique, under the Rectus Superior, that is, between that Muscle and the Globe ; and, increasing in Breadth, it is inserted posteriorly and laterally in the Globe near the Rectus Externus.

The Ring through which this Muscle passes is partly cartilaginous, and partly ligamentary : The cartilaginous Portion is flat, of a considerable Breadth, and semi-annular ; the ligamentary Portion adheres strongly to the two Extremities of the Cartilage, and is fixed in the small Fossula that lies in the Orbit, on the angular Apophysis of the Os Frontis. By means of this Ligament, the Ring is, in some measure, moveable, and yields to the Motions of the Muscle. To the anterior Margin of the Ring a ligamentary Vagina is fixed which invests the Tendon all the way to its Insertion in the Globe.

The OBLIQUUS INFERIOR is situated obliquely at the inferior Side of the Orbit, under the Rectus Inferior, which, consequently, lies between this Muscle and the Globe : It is fixed by one Extremity, a little tendinous, to the Radix of the nasal Apophysis of the Os Maxillare, near the Margin of the Orbit, between the Opening of the Ductus Nafalis and the inferior orbitary Fissure.

From thence it passes obliquely, and a little transversely, backward, under the Rectus Inferior, and is fixed in the posterior lateral Part of the Globe by a flat Tendon, opposite to, and at a small Distance from, the Tendon of the oblique Superior ; so that these two Muscles do, in some measure, surround the external posterior Part of the Globe.

The RECTUS SUPERIOR moves the anterior Portion of the Globe superiorly, when we lift up
the

the Eyes; the RECTUS INFERIOR carries this Portion inferiorly; the INTERNUS towards the Nose, and the EXTERNUS towards the Temples.

When two adjacent Recti act at the same Time, they carry the anterior Portion of the Globe obliquely towards that Side which answers to the Distance between these two Muscles; and when all the four Muscles act successively, they turn the Globe of the Eye round, which is what is called rolling the Eyes.

It is to be observed, that all these Motions of the Globe of the Eye are made round its Center; so that, in moving the anterior Portion, all the other Parts are likewise in Motion. Thus, when the Pupilla is turned towards the Nose, or superiorly, the Insertion of the Optic Nerve is, at the same Time, turned towards the Temple, or inferiorly.

The Use of the oblique Muscles is, chiefly, to counterbalance the Action of the Recti, and to support the Globe in all the Motions already mentioned. This is evident from their Insertions, which are in a contrary Direction to those of the Recti; their fixed Points, with relation to the Motions of the Globe, being placed anteriorly; and those of the Recti posteriorly, at the Basis of the Orbit. The soft Fat which lies behind the Globe is altogether insufficient to support it; neither is the Optic Nerve more fit for this Purpose: For it has been shewn, that this Nerve follows all the Motions of the Globe; which would be impossible, were not the Fat very pliable, and without Resistance. And to this we must add, that the Optic Nerve, at its Insertion in the Globe, has a particular Curvature, which allows it to be elongated; and, consequently, prevents it from suffering any Violence in the different Motions of the Eyes.

The Obliquity of these two Muscles does not hinder them from doing the Office of a Fulcrum ; because this is not a Fulcrum distinct from the Part moved, or on which the Globe of the Eye slides, like the Head of one Bone in the articular Cavity of another ; but, being fixed to the Part, it easily accommodates itself to all the Degrees of Motion thereof. Had these Muscles lain in a strait Direction, they would have incommoded the Recti ; but their Obliquity may be said to be, in some measure, rectified by the internal Surface of the Orbit and the Rectus Externus.

The internal Surface of the Orbit serves for a kind of collateral Fulcrum, which hinders the Globe from falling too far internally ; as the joint Action of the two Obliqui hinders it, in part, from falling too far externally. The Rectus Externus, by being bent on the Globe, not only hinders it from being carried externally, but also prevents the indirect Motions of the Obliqui from thrusting it out of the Orbit towards the Temples. The other Uses attributed to these Muscles, seem to me to be without Foundation, from the Consideration of their Insertions, and of the Structure of the Parts with which they are concerned ; both which Reasons are explained in the Memoirs of the Royal Academy of Sciences of Paris 1721.

The Office of the four Recti Muscles appears very plainly, in each of them apart ; as being bent round the convex Bulb of the Eye, as about a Pulley, they must, of course, elevate, depress, or turn the Globe of the Eye either to the Nose, or the Temple. Moreover, two of them, acting together, may turn the Eye in a Diagonal between the former Directions ; as superiorly, externally, internally, &c. Lastly, when all the four Muscles are contracted, there is no Doubt but they draw the whole Eye towards its Origin within the

the Orbit; by which means, the crystalline Humour is moved nearer to the Retina.

The major oblique Muscle draws the Globe anteriorly and superiorly, in a Manner, out of its Orbit, that the Eye may take in a larger Space of Vision; it also turns the Pupil interiorly and inferiorly: The other minor oblique Muscle seems to turn the Eye inferiorly and exteriorly (which Course is contrary to the former), to direct the Pupil upwards and inwards.

When any of the Branches of Nerves, which are distributed in these Muscles, are any way impaired, or the Muscles too much contracted or relaxed, either naturally, or by any other Means; it makes one squint; that is, when a Person looks at an Object, and turns his Eye towards it.

The GLOBE of the Eye being the most essential of all the soft Parts belonging to the Organ of Sight, and being, likewise, a Part which we are obliged to mention as often as we speak of the other soft Parts; must be first described. It is composed of several proper Parts; some of which, being more or less solid, represent a kind of Shell, formed by the Union of several membranous Strata called the Tunics of the Globe of the Eye: And the other Parts, being more or less fluid, and contained in particular membranous Capsulæ, or in the Interstices between the Tunics, are termed the Humours of the Globe of the Eye. These Capsulæ are likewise named Tunics.

The Tunics are of three Kinds. Some form, chiefly, the Shell of the Globe; some are additional, being fixed only to a Part of the Globe; and others are capsular, which contain the Humours. The Tunics which form the Shell, are three in Number. The external, to which the Convexity of the Globe is owing, is termed TUNICA SCLEROTICA, or CORNEA; the

middle Tunic is named CHOROÏDES; and the third, or interior, RETINA. The additional Tunics are two: One called TENDINOSA, or ALBUGINEA, which forms the White of the Eye; and the other, CONJUNCTIVA. The capsular Tunics are likewise two; the VITREA, and CRYSTALLINA.

The Globe of the Eye, thus formed, sends out posteriorly a pretty large Pedicle, which is a Continuation of the Optic Nerve. It is situated about the Middle of the Orbit in a Manner to be shewn, and is tied to it by the Optic Nerve, six Muscles, the Tunica Conjunctiva, and the Palpebræ. The posterior Part of the Globe, and the Optic Nerves and Muscles, are surrounded by a soft fatty Substance, which fills the rest of the Bottom of the Orbit.

The Humours are three in Number, the AQUEOUS, VITREOUS, and CRYSTALLINE. The first may properly enough be called a Humour, and is contained in a Space formed in the Interstices of the anterior Portion of the Tunics.

The second, or VITREOUS HUMOUR, is contained in a particular membranous Capsula, and fills above three Fourths of the Cavity of the Globe of the Eye. It is named Vitreous from its supposed Resemblance to melted Glass, but is really more like the White of a new-laid Egg.

The CRYSTALLINE HUMOUR is so called from its Similitude to Crystal, and is often named simply, the Crystalline. It is rather a gummy Mass than a Humour, of a lenticular Form, more convex on the posterior than on the anterior Side, and contained in a fine Membrane called MEMBRANA OR CAPSULA CRYSTALLINA.

What is here said is sufficient to give a general Idea of the three Humours of the Globe of the Eye.

The most external, thickest, and strongest, Tunic of the Eye, is the *SCLEROTICA*, or *CORNEA*; and it invests all the other Parts which the Globe is composed of. It is divided into two Portions; one called *CORNEA OPACA*, the other *CORNEA LUCIDA*, which is only a small Segment of a Sphere, situated anteriorly.

The *CORNEA OPACA* is composed of several Strata closely connected, of a hard compact Texture somewhat resembling Parchment: About the Middle of its posterior convex Portion, where it sustains the Optic Nerve, it is, in a Manner, perforated, and thicker than any-where else; its Thickness diminishes gradually towards the opposite Side, and its Substance is penetrated obliquely, in several Places, by capillary Vessels. The Course of the nervous Filaments through this Tunic is very singular: They enter the convex Side at some Distance from the Optic Nerve, and, running from thence through its Substance, pierce the concave Side near the *Cornea Lucida*.

The *CORNEA LUCIDA*, called likewise simply *CORNEA*; its opaque Portion, named *Sclerotica*, is composed, in like manner, of several Strata or Laminæ closely united, and appears to be a Continuation of the opaque Portion or *Sclerotica*, tho' of a different Texture. (When macerated in cold Water, it swells considerably.)

This Portion is somewhat more convex than the *Cornea Opaca*, so that it represents the Segment of a small Sphere added to the Segment of a greater; but this Difference is not equally great in all Persons. The Circumference of the convex Side is not circular like that of the concave, but transversly oval; for the superior and inferior Portions of the Circumference terminate obliquely; but this Obliquity is more apparent in Oxen and Sheep than in Man.

The Cornea Lucida is perforated by a great Number of imperceptible Pores, through which a very fine Fluid is continually discharged; which afterwards soon evaporates*. It is this Dew that forms a kind of Pellicle on the Eyes of dying Persons, which sometimes cracks soon after, as is observed in the Memoirs of the Academy of Paris for 1721.

The second Tunic of the Globe of the Eye is the CHOROÏDES, which is of a blackish Colour, more or less inclined to red, and adheres, by means of a great Number of small Vessels, to the Cornea Opaca from the Insertion of the Optic Nerve all the way to the Union of the two Corneæ, where it leaves the Circumference of the Globe, and forms a perforated Septum, by which the small Segment of the Globe is separated from the greater. This Portion commonly goes by the particular Name of UVEA, which was formerly given to the whole second Tunic; and, as it is of different Colours in several Subjects, it has, likewise, got the Name of IRIS: Which Term, however, agrees more precisely to the coloured Surface of this Portion; and would even be very improper for this Surface in Persons where it is uniformly brown, or blackish†.

The external Lamina of the Choroides is stronger than the internal, and both appear blackish, because of their Transparency: At a very small Distance from the Union of the two Corneæ this Lamina is most closely connected to the Cornea Opaca; round this Adhesion it changes Colour,

* We discover it evidently by pressing the Eye soon after Death, having first wiped it very clean: For we then see a gradual Collection of a very subtil Liquor, which forms itself into little Drops. And this Experiment may be several Times repeated on the same Subject.

† We are, as yet, unacquainted with the Origin of this Colour; nor can we perceive any Glandules, which some have assigned for it.

and forms a whitish Ring, of the same Breadth with the Adhesion; and near the Margin of the Sclerotica this Ring is stronger, and of a different Texture from what it is any where else. It adheres so closely to the Sclerotica, that, if we blow through a small Aperture made therein, without touching the Choroides, the Air will penetrate every where between the two Tunics, but cannot destroy this Adhesion, or pass to the Cornea Lucida. This Adhesion has been improperly named *LIGAMENTUM CILIARE*. On the internal Surface of this Lamina we discover a great Number of flat Lines in a vortical Disposition, which are the Vessels named by *STENO Vasa Vorticosa*, or *Vortices Vasculosi*.

The internal Lamina of the Choroides is thinner than the external; and its Surface, together with the corresponding Surface of the other Lamina, is covered by a blackish Substance with some Mixture of red, which easily separates when touched, and immediately tinges the Water in which the Choroides is dipped. The Origin of this Substance has not yet been discovered; but, after a nice anatomical Injection, a great Number of vascular Stars are observed on the internal Surface of this Lamina: And it is named, by some, *MEMBRANA RUYSCHIANA*.

The anterior Portion or perforated Septum of the Choroides has the Name of *UVEA*, and the Foramen near the Center of this Septum is called *PUPILLA*; the anterior Lamina of the same Septum is named *IRIS*, and the radiated Plicæ of the posterior Lamina, *PROCESSUS CILIARES*. Between the two Laminæ of the Uvea we find two very thin Planes of Fibres which seem to be muscular; those of one Plane being orbicular, and lying round the Circumference of the Pupilla; and those of the other being radiated, one Extre-

mity of which is fixed to the orbicular Plane, the other to the major Margin of the Uvea.

The Plicæ, or PROCESSUS CILIAIRES, are small radiated and prominent Duplicatures of the posterior Lamina of the Uvea, and their Circumference answers partly to that of the white Ring of the external Lamina: They are oblong thin Laminæ; their posterior Extremities, or those next the Choroïdes, being very fine and pointed; the others, or those next the Pupilla, broad, prominent, and terminating in acute Angles. In the Duplicature of each ciliary Plica we find a fine reticular Texture of Vessels; and some pretend to have seen muscular Fibres, in the same Place, lying in small Sinuses of the Membrana Vitrea, as we shall describe*.

The Space between the Cornea Lucida and Uvea contains the greatest Part of the aqueous Humour, and communicates, by the Pupilla, with a very narrow Space behind the Uvea, or between that and the crystalline: These two Spaces have been named the two Chambers of the aqueous Humour, one anterior, the other posterior; as will be observed in describing this Humour.

The third Tunic of the Eye is of a very different Texture from that of the other two Tunics. It is white, soft, tender, and, in a manner, medullary, or like a kind of Paste spread upon a fine reticular Web; which seems to be thicker than the Choroïdes, and reaches from the Insertion of the

* These supposed muscular Fibres are not visible even in the Eye of an Ox, as we have hitherto been able to observe; only there is one distinct Circle of obscure Fibres in the Body or interior Margin of the uveal Circle, in the human Fœtus, and in the Chicklings of Eggs: the Pupil is close shut, so that the Iris extended makes up a perfect circular Plane: The other Part of the Circle which surrounds the Pupil is vascular; this, by Degrees, contracts itself after Birth, and leaves a free Passage for the Rays of Light to enter through the Pupil. HALLER'S Physiolog.

Optic Nerve to the Extremities of the ciliary Radii, being equally fixed to the Choroïdes through its whole Extent. At the Place which answers to the Insertion of the Optic Nerve is observed a small Depression, in which lies a sort of medullary Button terminating in a Point; and from this Depression sanguineous Vessels egress, which are ramified, on all Sides, through the Substance of the Retina.

It is commonly said, that the RETINA is a Production or Expansion of the medullary Substance of the Optic Nerve; the Sclerotica, of the Dura Mater; and the Choroïdes, of the Pia Mater, which accompanies this Nerve: But this Opinion is not agreeable to what we observe in examining the Optic Nerve, and its Insertion in the Globe of the Eye. If we take a very sharp Instrument, and divide this Nerve, through its whole Length, between where it enters the Orbit and where it enters the Globe, into two equal lateral Parts, and then continue this Section through the Middle or Center of its Insertion; the following Phænomena will appear:

That the Nerve contracts a little at its Insertion into the Globe; that its external Covering is a true Continuation of the Dura Mater; that this Vagina is very different from the Sclerotica both in Thickness and Texture, the Sclerotica being thicker than the Vagina, and of another Structure; that the Vagina from the Pia Mater forms thro' the whole medullary Substance of the Nerve several very fine cellular Septa; and that where it enters the Globe of the Eye, the Pia Mater does not directly answer to the Choroïdes.

Lastly, That as the medullary Substance of the Nerve enters the Globe, it is very much contracted, and seems to terminate only in the small Tubercle or Button already mentioned; and that the

the Retina is too thick to be taken for an Expansion of the medullary Substance at this Place.

The Insertion of the Optic Nerve in the Globe of the Eye is, commonly, not directly opposite to the Pupilla; so that the Distance between these two Parts is not the same, when measured on all Parts of the Globe: The greatest Distance is ofteneft on the Side next the Temples, and the finallest next the Nose. An Inequality, of the same Kind, has been observed in the Breadth of the Uvea; which, in many Subjects, is less near the Nose than near the Temples; so that the Center of the Pupilla is not the same with that of the great Circumference of the Iris; and we have seen the same Difference in the Breadth of the Corona Ciliaris.

The VITREOUS HUMOUR * is a clear and very liquid gelatinous Fluid contained in a fine transparent Capsula, called TUNICA VITREA, together with which it forms a Mass nearly of the Consistence of the White of an Egg: It fills the greatest Part of the Globe of the Eye, that is, almost all that Space which answers to the Extent of the Retina, except a small Portion behind the Uvea, where it forms a Fossula in which the crystalline is lodged. This Humour, being dextrously taken out of the Globe, preserves its Consistence for some Time, in the Capsula, almost like the White of an Egg, and then runs off gradually, till it quite disappears.

The TUNICA VITREA is composed exteriorly of two Laminæ, very closely connected, which quite surround the Humour, and are immediately applied to the Retina all the Way to the great

* This Fluid seems to exhale from the small Arteries of the Iris, Uvea, and ciliary Processes; being absorbed, when there is too great a Quantity; or renewed again, if it be let out.

Circumference of the Corona Ciliaris; but from thence to the circular Margin of the Fossula of the Crystalline, this Tunic is full of radiated Sulci which contain the Processus Ciliares of the Uvea. At the Margin of the Fossula, the two Laminæ separate, and form a particular Capsula which belongs to the Crystalline.

The internal Lamina of the Tunica Vitrea gives off, through the whole Substance of this Humour, a great Number of cellular Elongations, or Septa, so extremely fine, as not to be at all visible in the natural State, the whole Substance appearing then to be uniform and equally transparent throughout: But they are discovered by putting the Whole, soon after it is taken out of the Body, into some acescent and gently coagulating Liquor.

The radiated Sulci of the Tunica Vitrea, which may be termed Sulci Ciliares, are perfectly black, when the Tunic is taken out of the Body: This proceeds from the black Substance with which the Laminæ or Processus Ciliares are naturally covered, as well as all the rest of the Choroïdes, and which remains at the Bottom of the Sulci, after the Laminæ have been taken out. We observe very fine Vessels in this Humour.

THE CRYSTALLINE HUMOUR is a small lenticular Body, of a pretty firm Consistence, and diaphanous like Crystal: It is contained in a transparent membranous Capsula, and lodged in the anterior Fossula of the vitreous Humour, as has been already said. It is very improperly called a Humour; because it may be handled and moulded into different Shapes by the Fingers, and sometimes almost dissolved by different reiterated Compressions, especially when taken out of the Capsula.

The Figure of the Crystalline is lenticular, but its posterior Side is more convex than the anterior, the Convexity of both Sides being very rarely equal.

equal. The internal Structure of this Mass has not been hitherto sufficiently known to be described with Certainty, especially in Man, where we could never find that contorted Disposition of crystalline Tubes which some pretend to have seen in the Eyes of large Animals.

The Colour and Consistence of the Crystalline varies in different Ages, as was discovered by Dr. PETIT, and demonstrated by him, in the Academy of Sciences, from a great Number of human Eyes; and his Observations are inserted in the Memoirs for 1726. Till the Age of Thirty it is very transparent, and almost colourless; afterwards it becomes yellowish, and that Yellowness gradually increases: The Consistence varies almost in the same Manner; being of a uniform Softness till the Age of Twenty, and afterwards growing gradually more solid in the Middle of the Mass: But in this there are Varieties, explained in the Memoirs for 1727.

The crystalline Capsula, or Tunic, is formed by a Duplicature of the Tunica Vitrea, as has been said: The external Lamina covers the anterior Side of the crystalline Mass; the internal Lamina covers the posterior Side, and likewise the Fossula Vitrea, in which the Crystalline is lodged. The anterior Portion of the crystalline Capsula is thicker than the posterior, and, in a manner, elastic; and both its Thickness and Elasticity may be discovered in Dissection, without any other Artifice*.

* The anterior Portion swells when macerated in Water, and then appears to be composed of two Pelliculæ, united by a fine spongy Substance. I demonstrated this Duplicature very plainly, in the Eye of a Horse, by the Knife alone; and I even carried the Separation of the two Laminæ as far as the vitreous Tunic. Having made a small Aperture in the Middle of the Capsula, and blown into it through a Pipe, some Part of the Air remained between the Margin of the crystalline Mass and that of the Capsula, in Form of a transparent Circle. This Experiment was made with the Eye of an Ox, above thirty Years ago. WINSLOW.

In examining the human Eye, we have found, that the Retina, having reached the great Circumference of the Corona Ciliaris, becomes very thin, and is continued between the Laminæ or Processus Ciliares of the Uvea and the ciliary Sulci of the Tunica Vitrea, all the way to the Circumference of the Crystalline. It is, perhaps, this Continuation which makes the Processus Ciliaris to be covered by a whitish Pellicle, and likewise increases the Thickness of the anterior Portion of the Capsula Crystallina.

THE AQUEOUS HUMOUR is a very limpid Fluid resembling a kind of Lympha, or Serum, with a very small Degree of Viscidity; and it has no particular Capsula like the crystalline and vitreous Humours. It fills the Space between the Cornea Lucida and Uvea, that between the Uvea and the Crystalline, and the Aperture of the Pupilla. These two Spaces are called the Chambers of the aqueous Humour, and are distinguished into the anterior and posterior.

These two Chambers are not of the same Extent: The anterior, which is visible to every Body between the Cornea Lucida and Uvea, is the largest; the other, between the Uvea and Crystalline, is very narrow, especially near the Pupilla, where the Uvea almost touches the Crystalline. This Proportion between the two Chambers has been sufficiently proved, contrary to the Opinion of many antient Writers, by HEISTER, MORGAGNI, and several Members of the Royal Academy; but none has treated these Matters at so great a Length as M. PETIT the Physician, as appears by the printed Memoirs of that Society.

VESSELS OF THE EYE, AND ITS APPENDAGES.

The external carotid Artery, by means of the *Arteria Maxillaris Externa* and the temporal and frontal Arteries, give several Ramifications to the Integuments which surround the Eye, and to all the Portions of the *Musculus Orbicularis*; and these Ramifications communicate with those which are distributed to the *Membrana Conjunctiva Palpebrarum*, and to the *Caruncula*.

The same external Carotid, by means of the *Arteria Maxillaris Interna*, sends a considerable Branch into the Orbit through the Optic Foramen, or Spheno-Maxillary Fissure, which is distributed to the Periosteum of the Orbit, the Muscles of the Globe of the Eye, the *Levator Palpebræ Superioris*, Fat, *Glandula Lacrymalis*, *Membrana Conjunctiva* of the Eye and *Palpebræ*, and to the *Caruncula*, &c. It communicates with the internal Carotid, and sends a small Artery to the ethmoid Cells of the Nose; through the small, internal, posterior, orbitary Foramen.

The internal carotid Artery having entered the Cranium, sends off small Rami which accompany the Optic Nerve, and those which pass through the *Fissura Spheno-Maxillaris*: One of these small arterial Branches runs into the Substance of the Optic Nerve, and produces, on the Retina, the small Arteries which appear very plainly on the internal Sides of that Membrane; the rest join the Ramifications of the external Carotid already mentioned, and, having penetrated the Substance of the *Tunica Sclerotica* posteriorly, and run a little way through that Substance, they perforate this Membrane interiorly, in five or six Places, at an equal Distance from the Optic Nerve and Pupilla.

Af-

Afterwards they perforate the external Lamina of the Choroïdes in the same Number of Places, and form, between that and the internal Lamina, the Vasa Vorticosa of STENO, and the vascular Stellæ mentioned in the Description of this internal Lamina: Some small vascular Filaments, from these Ramifications, are likewise observed to adhere very closely to the Tunica Vitrea; and, before they form the Vasa Vorticosa, they send small Arteries; in a direct Course, to the Circumference of the Uvea, where they form a vascular Circle, which sends out Capillaries as far as the Membrana CrySTALLINA, which are very easily injected in new-born Infants.

The Veins of all these Parts answer nearly to the Arteries: The internal Veins discharge themselves partly into the internal jugular Vein by the Sinus Orbitarii, Cavernosi, and Petrofi; and partly into the external jugular Vein by the Vena Angularis or Maxillaris Externa, Maxillaris Interna, Temporalis, &c.

Besides the capillary Vessels, easily distinguishable by the red Colour of the Blood, there are great Numbers of those which admit nothing but the serous and lymphatic Parts of the Blood, and, consequently, do not appear in the natural State: They become visible, in some Places, by Inflammations and Injections, as on the Membrana Conjunctiva of the Eye; but these Contrivances do not discover them every-where in aged Persons. In a Fœtus, and new-born Infants, a fine Injection has succeeded so well, as to discover the Vessels of the Membrana CrySTALLINA and Vitrea; and in a Fœtus of about six Months, the injected Liquor seemed to me to have penetrated a Part of the crystalline and vitreous Humours, WINSLOW.

NERVES OF THE EYE, AND ITS APPENDAGES.

Besides the Optic Nerve, the Globe of the Eye receives several small Nerves, which run, on each Side, along and about the Optic Nerve, from its Entry into the Orbit to its Insertion in the Globe: These Filaments come chiefly from a small lenticular Ganglion, formed by very short Rami of the orbitary or ophthalmic Branch of the fifth Pair, and by a Branch of the third Pair, or Motores Oculi.

These nervous Filaments of the lenticular Ganglion, having reached the Globe of the Eye, are divided into five or six Fasciculi; which, having surrounded the Optic Nerve, and penetrated and perforated the Cornea Opaca or Sclerotica, run, at Distances more or less equal, between the Sclerotica and Choroïdes towards the Uvea: There each of them is divided into several short Filaments, which terminate in the Substance of the Uvea. These small Nerves, which run from behind forwards between the Sclerotica and Choroïdes, have formerly been taken for particular Ligaments by very great Anatomists.

The Nerves which go to the other Parts belonging to the Eye, come from the third, fourth, sixth, and first two Branches of the fifth Pair of Nerves of the Medulla Oblongata; and likewise from the Portio Dura of the seventh Pair: The third, fourth, and sixth Pairs, give Nerves to the Muscles of the Globe of the Eye; the two Branches of the fifth Pair, and the Portio Dura of the seventh, give Nerves not only to the other Parts which surround the Globe, but also to the Musculi Frontales and internal Parts of the Nose.

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The Trunk of the third Pair, or *Motores Oculi*, having entered the Orbit through the superior Orbital or sphenoid Fissure, produces four Branches: The first ascends and divides into two; one for the *Musculus Rectus Superior*, and the other for the *Levator Palpebræ Superioris*. The Trunk, continuing its Course, gives off the second short Branch to the *Rectus Inferior*; the third Branch is long, and goes to the *Obliquus Inferior*; contributing, likewise, to the Formation of the lenticular Ganglion already mentioned; the fourth Branch is large, and supplies the *Rectus Internus*.

The first Branch of the fifth Pair, commonly named *Nervus Ophthalmicus*, divides into three Rami, as it enters the Orbit, and sometimes only into two; one of which is afterwards subdivided: Of these three Branches, one is superior, which is named *Nervus Superciliaris*; one internal, termed *Nasalis*; and one external, to which the Name of *Temporalis* agrees better than that of *Lacrymalis*, which may occasion a Mistake.

The superior or superciliary Ramus runs along the whole Periosteum of the Orbit; and, having passed through the superciliary Fissure or Foramen of the *Os Frontis*, is distributed to the *Musculus Frontalis*, *Superciliaris*, and superior Portion of the *Orbicularis Palpebrarum*; and it communicates with a small Branch of the *Portio Dura* of the seventh Pair.

The internal or nasal Branch passes under the Ramification of the Nerve of the third Pair, and, running towards the Nose, is distributed thereto, and to the adjacent Parts of the *Orbicularis*, *Caruncula*, &c. This Branch sends off a Filament, which, passing through the internal, anterior, orbital Foramen, enters the Cranium, and directly returns again, thro' one of the ethmoid Aperture, to the internal Parts of the Nose. We

have sometimes observed this nasal Ramus to communicate with the Ramus Superciliaris, by a particular Curvature, before it enters the orbitary Foramen.

The external or temporal Ramus, which is sometimes a Subdivision of the Superciliaris, is distributed to the Glandula Lacrymalis, and sends off a Filament which pierces the orbitary Apophysis of the Os Malæ.

The second Branch of the fifth Pair, called Nervus Maxillaris Superior, sends off a Ramus through the osseous Canal of the inferior Part of the Orbit; which, going out at the anterior inferior orbitary Foramen, is distributed to the adjacent Portion of the Musculus Orbicularis, and communicates with a Ramus of the Portio Dura.

The Portio Dura of the seventh Pair or auditory Nerve, which is called Nervus Sympatheticus Minor, gives Rami to the superior, inferior, and external lateral Parts of the Orbicularis Palpebrarum; one of which communicates with the Nervus Superciliaris, and another with the Sub-Orbitarius, as we shall observe in the Description of the Nerves.

USES OF THE EYE, AND ITS APPENDAGES IN GENERAL.

Every-body knows that the EYE is the Organ of Vision. The transparent Parts of the Globe modify the Rays of Light, by different Refractions; the Retina and Choroides receive the different Impressions of these Rays, and the Optic Nerve carries these Impressions to the Brain. When Objects are at a great Distance, or obscure, the Pupilla is dilated; and it is contracted when Objects are near, or placed in a great Light. The Muscles

Muscles of the Globe of the Eye and the Palpebræ perform the Motions already described.

The Glandula Lacrymalis continually moistens the anterior Part of the Globe of the Eye, and the lacrymal Serum is equally spread over that Globe by the Motions of the superior Palpebra, the internal Surface of which is, in some measure, villous. The Union of the two Palpebræ directs this Serum towards the Puncta Lacrymalia, and the unctuous Matter discharged through the Foramina Ciliaria hinders it from running out between the Palpebræ: The large Size and viscid Surface of the Caruncula prevents it from running beyond the Puncta, and thus forces it into them.

The Supercilia may hinder Sweat, &c. from falling on the Eyes; the superior Cilia, which are longer than the inferior, may have the same Use; and they both serve to prevent Dust, Insects, &c. from entering the Eyes when they are only a little open.

OBSERVATIONS.

There are other more minute muscular Motions performed in the Eye, which presuppose a Knowledge of the Nerves belonging to this Organ.

And, 1. We have described the Optic Nerve. The fourth Pair goes only to the larger oblique Muscle, and the sixth Pair belongs to the external Rectus. The third and fifth Pairs produce the principal Nerves in the Eye; and, of these, the first Branch or the fifth produces the ophthalmic Nerve, and sends off a small Nerve from its Entrance into the Orbit, to the Eyelid and lacrymal Glandule: It is then conjoined with the second Branch of the fifth Pair, and with the temporal Branch of the third and fifth Pairs, and, after having entered the Orbit, its Trunk divides into two; of which, the superior and larger subdivides into two, which are spent upon the Forehead and

Eyelids ; but the inferior, going interiorly above the Optic Nerve, sends out long slender Filaments to the exterior Part of the Nerve, which, joining with another Filament of the third Pair, forms the ophthalmic Ganglion. Finally, Having given off a Nerve, running to that of the Nose, it is then lost upon the Parts of the internal Angle of the Eye.

The principal Office of the third Pair is, in giving off a Branch superiorly to the strait Muscles of the Eye and Eyelids ; and then, going anteriorly with its Trunk under the Optic Nerve, it sends out three Rami to the inferior and less Obliquus, and to the internal strait Muscle ; after this, and often before (from its Trunk, and sometimes from the inferior Obliquus, ascends out another short and much thicker Nerve, which sometimes joins the Radix of the fifth, or is sometimes solitary ; which, under the abductor Muscle, constantly forms the oval ophthalmic Ganglion. From that Ganglion, and sometimes from the Trunk of the third or fifth, egress four or five capillary Nerves in a curved Course, playing round the Optic Nerve in their Course to the Globe of the Eye ; where they enter the Sclerotica, almost in its Center, in Company with its longer small Arteries or Veins ; and running hence, strait forwards through the Choroides, they pass visibly to the Iris, and, seemingly, to the ciliary Processes.

Upon these Nerves depend, manifestly, the Sensibility of the Iris, which contracts itself in all the stronger Degrees of Light, and dilates itself in all the weaker Degrees ; and from thence to the Pupil is enlarged, in viewing all remote Objects, and contracted when we look at Things very near the Eye.

The Cause of Dilatation seems to be an Abatement of the Powers resisting the aqueous Humour ;

mour; as we see, for Example, in the Dilatation that ensues from Weakness, Fainting, or Death. The Constriction is indeed more obscure, and perhaps arises only from a stronger Influx of Humours to the colourless Vessels of the Iris, by which the said Vessels are extended, together with the Iris, which is thereby elongated, so as to shut up the greater Part of the Pupil.

In Children the Pupil is more sensible, and more evidently contracted or dilated; but in old People the Parts of the Eye growing callous, it becomes, at last, almost immoveable. Other small Nerves are extended from the same Ganglion to the Sclerotica.

Another more obscure and less easily demonstrable Motion in the Eye is, that of the ciliary Processes; which, lying incumbent upon the Furrows of the vitreous Membrane, seem, by their Action, to press back that Body, so as to bring the crystalline Lens forwards, and separate or remove it farther from the Retina*.

The sanguiferous Vessels of the Eye itself come from the ophthalmic Artery, a Branch of the internal Carotid: This, creeping along under the Optic Nerve, sends out, as principal Rami, the superior and inferior Ciliares, one or more; the Lacrymalis, whence the posterior running to the Nose, and internal Part of that belonging to the Curvature of the Tarsus; afterwards the Muscularis Inferior, the anterior recurrent to the Nose, superior Musculares, and Palpebralis;

* As for any Sphincter of the Pupil, or a Constrictor of the Cornea, mentioned by some Writers of Note; or even moving Fibres, which others have imagined proper to the crystalline Lens; they are in no wise supported by Dissection; nor are they consistent with the perpetual Hardness of Texture observable in the Lens and Cornea of most Animals.

whence, with the former Ramus, springs the Curvature of the Tarsus.

Lastly, It egresses anteriorly to the Face and adjacent Parts of the Nose; but the ophthalmic Rami, belonging to the internal Fabric of the Eye, are the posterior and middle Ciliares; which, arising from the Trunks before mentioned, and playing round the Optic Nerve, in four or more Rami, in a serpentine Direction, go partly in with the Optic Nerve at its first Entrance, and are partly extended farther to near the Middle of the Sclerotica, where they send in twenty or more little Arteries to the Choroides, which make first beautiful Ramifications upon the external Surface of that Membrane, round and like the Branches of Trees, from whence they proceed internally, in a direct Course, and extend some of their Branches as far as the Cohesion of the Iris with the Cornea and Choroides; and here each Ramus, dividing to the Right and Left, and intermixing with others of the same Kind, at last go to complete the arterial Circle of the Uvea.

To the Composition of the same Circle concur many other small Arteries; as the anterior Ciliares, which, arising from the muscular Rami of the Ophthalmic near the Origin of the pellucid Cornea, perforate the Sclerotica by twelve or more Rami, and, together, make up the Circle of the Pupil. From that Circle, and likewise from the forementioned arterial ciliary Arteries, independent of the middle Circle, are distributed Vessels, both on the anterior Face, which makes the Iris; and on the posterior Face of the Uvea, together with the ciliary Processes, the Vessels are distributed both strait and ramified; the Iris is full of Liquor of a bluish Colour, otherwise brown; and the Uvea is spread with a good deal of black Paint,
without

without which it is naturally white, and sends small pellucid Rami even into the crySTALLINE Lens, as has been distinctly seen.

From the same Ophthalmic and its Trunk, or from the lacrymal Branch, or from one of the Ciliares, one or more Rami enter the Optic Nerve; the principal of these, being single, penetrates through the Medulla of the Nerve, and, egressing from the Middle or Apex of the Papilla, divides in the Center of the Retina; from thence, spreading its Branches every way, in Company with the Retina itself. Sometimes a second or lesser Branch goes along the Center of the Nerve to the Retina, and is, in like manner, ramified through it. It is, probably, from these Branches that the minute pellucid ones of the vitreous Tunic are produced. The Center of these Arteries, entering the Retina, is the celebrated Porus Opticus, or blind Point of the Antients.

The Veins of the Eye, in general, being ramified, like Trees, in the Choroïdes, conduce but little to the Formation of the Circle of the Uvea: They arise from the ophthalmic Vein, which here comes from the Vein of the Face, and, egressing from or under the osseous Orbit, is inserted into the cavernous Sinus.

The internal Veins of the Eye are fewer in the Middle of the Sclerotica, which they perforate with larger Trunks, and form Bushes, or Trees, somewhat bigger, and more anterior, than those of the Arteries; and another Vein perforates the Center of the Optic Nerve, and is lost in the Retina like the Artery.

The pellucid or aqueous Vessels differ not, in their Course, from those which convey Blood. There are, also, lymphatic Vessels, said to have been seen by some in the Retina; but the Observation has not been often enough repeated, for us to rely on. HALLER. Prim. Lin. Physiol.



LECTURE VI.

Of VISION.

SO far with Respect to the Anatomy of the Eye; and that the Action of this Organ lies wholly in the Reception of Light, excepting only a few Doubts, appears very plain, from physical and mechanical Experiments.

Light, then, is a Matter either the same, or very nearly approaching to that of Fire, extremely fluid and subtil, penetrating even the hardest Bodies, without receiving Alteration, from any Distance, in its Course; moving with such an exceeding Velocity, as to run through the Magnus Orbis in about sixteen or seventeen Minutes of Time.

The Light of our Atmosphere proceeds either from that of the Sun, whose Body seems to have the Power of impelling to us, in right Lines, the Matter of Light, which is confusedly spread around; or else it proceeds from some other ignited Point, or lucid Body, whence the Rays spread every Way, as from a Center, to all Points of a large Sphere, so as to fall upon the Surfaces of Bodies; whence, again, it is reflected to the Eye, from the enlightened Surfaces, in Angles equal to those of their Incidence; so as to render the Bodies, whence it thus flows to the Eye, visible, and coloured,

It is now sufficiently evidenced, by Experiments, that Light is composed of Rays propagated in right Lines, almost without any physical Breadth or Thickness; and yet so that each of these Rays are again separable into several other permanent and immutable Rays of a lesser Kind.

The known Properties of these Rays are, that all of them, conjoined together, constitute a white Beam; which, being refracted by the minute Surfaces of Bodies, are subdivided into Rays of a red Colour, which are most constant or permanent, hard, and least refrangible; next to which follow those of an orange, yellow, green, blue, indico, and violent Colour; of which, those are always weaker, and more refrangible, which are farther distant, in Order, from the red Rays.

A Shadow arises from a Deficiency in the reflected Rays. Those primitive Rays, variously compounded together with Shade, compose all the Variety of Colours: The Colours, then, which seem proper to Bodies, arise hence; that the minute Surfaces of their constituent solid Particles, by which their Pores or Vacuities are limited, do, according to the Difference of their Thickness, Density, &c. reflect or separate the Rays of Light so as to send more of one Kind or Colour to the Eye than another; whilst most of the remaining Rays are lost, by repeated Reflexions, within the Pores of the Substance, so that the strongest and thickest Particles reflect a white Colour, those next in Density and Size a red; till, at last, the minutest Surfaces reflect a violet Colour.

Those Bodies are opaque, which retain the Rays within their Substance without permitting any to pass through them; which seems to follow from the Largeness and Number of the Pores, to the Sides of which the Light is attracted; which Pores are filled with some Matter that has a refractive Power

Power different from that which the Light suffers from the Parts of the Body itself*.

These Rays, falling obliquely upon the Surfaces of Liquors of various Densities, pass thro' them with a Change in their Direction, by variously receding from, or approaching nearer to, a Perpendicular, excepting only inflammable Liquors; which, by a peculiar Property, attract them more to a Perpendicular than in Proportion to the Density of the Liquor. The Proportion of the Angles of Incidence to those of Refraction are observed to be constant enough; so that the Sine of Refraction from Air into Water, is to the Sine of the Angle of Incidence, as 4 to 3; and, in passing from Air into Glass, the Sine of Incidence is to that of Refraction as 17 to 11; and from Water into Glass, as 31 to 44.

Rays which pass through the Air diverging but a little (as do those of the Sun, on account of their immense Distance; and as, in general, do any Rays which come from the Distance of above 100 Feet), falling upon a denser Body, are so refracted, as to meet in a Point, which is called their Focus; and this Point always falls within the Axis, or Radius, which is perpendicular to the Surface, whence it becomes permanent and unchangeable; so that the Focus of Rays passing from Air into a Sphere of Water, will be distant from the Axis one Semi-diameter of the Sphere; and, in a globular Glass, it will be distant a fourth Part of the Diameter; but in a convex Lens of Glass, that is, a Segment of a Sphere not less than

* We embrace these Principles till a new Theory, that places the Diversity of Colours, like those of Sounds, in Vibrations of different Celerities, shall be better established; although, in Reality, we are but little concerned, as to our Experience, in this or any other Theory.

thirty Degrees, and equally convex, the Focus will be likewise distant one Semi-diameter; yet so, that the Rays will not unite in a Point, but in a small Circle.

Therefore the Rays of Light, whether direct or inflected, fall in such a Manner upon the Tunica Cornea of the Eye, as to form a very acute Cone between the lucid Point and the Membrane upon which they are spread; the Basis of which Cone will be the Surface of the Cornea, and the Vertex in the radiant Point; yet so that each Ray in this Cone may, without any sensible Error, be reckoned parallel to each other. Among these, there are some Rays reflected back from the Cornea without ever penetrating the Surface; namely, all such as fall upon that Membrane in an Angle greater than forty Degrees; and other Rays, which enter the Cornea at very large Angles, but less than the former, and fall in between the Uvea and crystalline Lens, are suffocated and lost in the black Paint which lines the Uvea and ciliary Processes: But those Rays, only, fall upon the Surface of the crystalline Lens, which enter the Cornea at small Angles, not far distant from the Perpendicular, or, at most, not exceeding twenty-eight Degrees: By this means, all those Rays are excluded which the refractive Power of the Humours of the Eye could not be able to unite on the Retina, without which they would paint the Image of the Object too large, and confused.

Those slender Rays, therefore, coming thus to the thick Cornea, which is denser than Water, and a spherical Segment; are considerably refracted, and pass through it, in a more considerable Degree, towards the Perpendicular; namely, about a fourth Part: But these Rays, falling with but a small Convergency upon the aqueous Humour, which is but small in Quantity, and almost

like Water, making there no Focus, on account of the Nearness of the Humour to the Cornea; go on nearly parallel, or but little converging, to the next adjacent Surface of the very pellucid or crystalline Lens, because their Divergency was considerably corrected by the refractive Power of the Cornea. Moreover, the Cornea, being convex, and a Segment of a less Sphere than that of the Sclerotica, receives and collects a greater Number of Rays than if it was flatter, and with a less Surface.

The refractive Power of the crystalline Lens, which exceeds that of Water, may be understood from its Hardness, greater Density, or Weight; which, by some kind of Experiments, is computed to be equal to the refractive Power of a Diamond, so as to make the refracted Angle Half that of the incident: Or, by other Experiments, if the Lens be compared with Glass, its Refraction will be somewhat less; namely, about One and a Half. In this Lens, therefore, especially its posterior very convex Side, the Rays will converge much, and pass from thence to the vitreous Humour.

The vitreous Humour is denser than Water, in which it sinks; but less dense than the crystalline Lens; and continues to bend the Rays towards the Perpendicular, till, at length, in a well-formed Eye, the Rays, coming from the Point of distinct Vision, are collected on a very small Part of the Retina, where they paint an Image of that Object whence they come, but in a Position inverted, from the necessary Decussation or crossing of the Rays.

The Manner in which the Images of Objects are thus painted, may be seen experimentally in an artificial Eye, or by a natural one, when the back Part of the Sclerotica is cut off, and a Piece of
Paper

Paper placed to receive the Image of the Object : But the Image we see is painted on the external Side from the Optic Nerve, within the Limits of the visual Axis, yet so that it is not a real Point, but has some Degrees of Breadth ; since we see many Objects at once, whose Images must be in distinct Points of the painted Field ; and there an Object is seen the more distinct, because the Rays arrive thither nearly perpendicular. But frequently this Point of Vision does not fall on the same Place in both the Eyes*.

But since the necessary Offices of human Life require a distinct Image to be painted upon the Retina, not only by the Rays which come from a certain Distance, but likewise by Rays which come from very different Parts more or less distant ; therefore Nature has made the crystalline Lens moveable by the Powers before mentioned : For, without this Motion of the Lens, we see Objects that are either remote, or very near, after a Manner, indistinctly† : Also, in an artificial Eye, the Use and Necessity of this Motion may be plainly perceived : Therefore so great a Divergency of the Rays, as in those which come from Objects very close to the Eye, is collected by a Removal of the Lens farther from the Retina, so as to bring the Focus of the diverging Rays upon the Retina itself, which would otherwise have fallen behind the Eye : For the refractive Power of the Eye being determined, that which will unite the Focus of Rays coming from the Distance of three Feet, so as to make them fall perfectly upon the

* When the crystalline Lens has been couched, or displaced, the vitreous Humour, with a weaker refractive Power, usually suffices to bring the visual Rays to a Focus.

† This Art of seeing distinctly we learn by Experience ; it being unknown to an Eye lately couched of a Cataract.

Retina, will not be able to collect, into the same Point, those Rays which come from the Distance of three Inches; and Rays still more diverging will meet yet farther behind the Eye, if they are not collected by a greater Refraction.

But those Rays which come from Parts very remote, and which may be, therefore, accounted parallel, will unite, before the Retina, in the vitreous Humour, and again separate, according to the Nature of Rays, from the Point of Concourse, as if it was a lucid Point: To remedy which, therefore, those Powers remove the crystalline Lens back from the Cornea, nearer to the Retina; that the Rays, which come from a certain Distance to the Lens, may be also united, at a certain proportionable Distance, on the Retina.

For an Eye that will collect the Rays coming from seven Inches Distance, so as to unite them on the Retina, will collect those sooner, or before the Retina, which flow from the Distance of three Feet. It was therefore absolutely necessary for the Eye to be made thus changeable, that we might be able to see distinctly at various Distances. But the Point of distinct Vision is in that Part of the Retina where the given Object is painted in the least Compass possible*.

But this Artifice of the Eye is, however, not alone sufficient in all Persons: For there are now greater Numbers of People than formerly, employed in a studious or sedentary Life, and taken up with the Observation of more minute Objects, by which the Cornea is rendered more convex and dense, and the crystalline Lens more solid, and of

* The Powers causing the visual Rays to converge or unite on the Retina, are often very different in the two Eyes of one and the same Person, so as to render one Eye nearly presbyoptical, or long-sighted; and the other myoptical, or short-sighted.

less Segments ; while the Eye itself, by the Weight of the Humours, is more elongated, and the rest of the Humours are, probably, more densified ; many or all which Circumstances attend the Eyes of some Persons. In such, the Iris is sensible in a small Light ; whence, by winking, or straining the Eyelids, they are denominated Myopes, short or near-sighted. In these, the Point of distinct Vision is very near to the Eye, from one to seven Inches before the Cornea ; but they see remoter Objects more obscurely, without being able to distinguish their Parts.

The Reason of this is evident ; since, from the forementioned Causes, there is a greater refractive Power of the Humours, by which the distant, and, consequently, parallel Rays are obliged to meet in their Focus before the Retina ; from whence, spreading again, they fall upon the Retina in many Points. Thus, also, to a good Eye, the Sense of Objects ; because the Rays, coming from thence, are spread all over the Retina, without being collected towards the Center.

The Remedy for this Defect in the Sight is, to correct it in its Birth, in viewing distant Places by keeping the Eyes from minute or near Objects, and by the Use of concave Glasses ; or by viewing Things through a small Hole, by which the Light is weakened. When this Disorder is confirmed, the Remedy is a concave Lens, which takes off a Degree of the refractive Power in the Humours, Cornea, and crystalline Lens, in Proportion as it is more concave ; by which means, the Focus of Rays, from remote Objects, is removed farther behind the Cornea, so as to fall upon the Retina.

This Glass ought to be a Portion of a Sphere whose Diameter is equal to the Distance of distinct Vision, to the naked Eye, squared by the Distance
of

of distinct Vision in the armed Eye, and divided by their Excess*.

Another Disorder of the Sight, contrary to the former, attends those who are often looking upon very distant Objects, and is, more especially, familiar and incurable in old Age; whence those Persons, thus disordered, are called Presbyopi. In such, the Cornea and crystalline Lens are flatter, and the Humours of the Eye have a less refractive Power. Hence near Objects, whose Rays fall very diverging upon the Cornea, appear confusedly; because the converging or refractive Powers of the Eye are not sufficient to unite the Rays in a Focus upon the Retina; but they go on scattered through the Retina, and through the Point of their Pencil behind the Eye: Hence Vision is confused. The Point of distinct Vision in Presbyopi, or old or long-sighted Persons, is, from the Distance of fifteen to thirty Inches.

Such Persons are, in some measure, relieved by looking through a black Tube held before the Eye; by the Use of which, the Retina grows tenderer, and the Rays pass in a more parallel Direction. The Remedy for which is, a convex Lens of Glass, which may cause the Rays to converge and unite sooner in a Focus, that it may not fall behind the Eye, but upon the Retina. The Diameter of the Sphere, which such a Lens ought to be a Portion of, is determined as before.

A Medium between short and long-sighted is the best; by which a Person can see, distinctly

* Age itself, advancing, gives some Relief to short-sighted Persons: For Children are, in a Manner, naturally myoptical: But as the Eye grows older, it becomes flatter, in Proportion as the Solids grow stronger; and, contracting to a shorter Axis, the converging Powers of the Lens and Cornea are diminished.

enough,

enough, Objects which are both near and remote : And of this Kind we reckon an Eye that is able to read distinctly at the Distance of a Foot. But to this are to be added other necessary Conditions : Such as a perfect Clearness of the Humours, a due Mobility of the Eye itself and its Parts, with a Sensibility of the Pupil and Retina, neither too tender, nor too tough.

But the Mind not only receives a Representation of the Image of the Object by the Eye, impressed on the Retina, and transferred to the common Sensory or Seat of the Soul ; but she learns or adds many Things, from mere Experience, which the Eye itself does not really see ; and other Things the Mind considers or interprets to be different from what they appear to her by the Eye.

And, 1. The Magnitude of an Object is judged of by an optical Angle intercepted, as the Basis of a Triangle, betwixt the Cornea ; and, as the Point of a Cone, betwixt the radiant Object. Hence Things very near seem large, and remote Objects small.

Hitherto may be referred the Power of Microscopes, by which Objects are made to appear to us so much larger, as the Distance of the Focus of the Lens or Magnifier is less than the Distance of distinct Vision ; when, in Reality, they do not appear larger, only more distinct and lucid, when the Mind judges them to be larger, or nearer.

The Strength of visual Light, likewise, is proportionable to the same Angle, in the external Day Light ; and the Multitude or Number of the Rays, joined with the Smalness of the Seat which they affect on the Retina, occasions near Objects to appear brighter, and distant ones more obscure ; or if a remote Object appears bright by its own Light, the Mind represents it either as one large, near at Hand, or both.

The Place of a distant Object appearing to the Eye, is estimated by the Concourse of two Lines, drawn from the Center of the seeing Eye till they meet or join in the Space that lies betwixt the Point in which the Object appears visible in the right Eye, to the same Point in the left Eye; which Lines, if they no-where intersect each other, will represent the Object double; or, if they meet upon each other, we place the Seat of the Object in the Point of Intersection.

But Distance we are not able to see, only we judge of it from the Diminution of Magnitude before known, as well as from the Angle intercepted betwixt the two optical Axes, together with the same Weakness of Light, and Paleness or Faintness of the Image, coming from the Object in Conjunction with the vast Number of intermediate Bodies whose Distances were before known to us. But we find, that all Things are fallacious which are not founded in the infallible Wisdom of the Creator, but arise by Experiences in the Judgments of Mankind.

Thus the Convexity or Protuberance of a Body is not seen, but is afterwards judged of by Experience, after we have learned that a Body, which is convex to the Feeling, causes a certain Mode or Habit in Light and Shadow. Hence it is that Microscopes frequently pervert the Judgment, by transposing and changing the Shadows.

The visible Situation of the Parts of an Object are judged, by the Mind, to be the same with that which they naturally have in the Object, and not the inverted Position in which they are painted upon the Retina: But it is certainly a Faculty innate or born with the Eye, to represent Objects upright to the Mind whenever they are printed inverted upon the Retina: For new-born Animals always see Things upright, and are never mistaken in

in enquiring for their Mothers; and Men, who have been born with Cataracts, without ever being able to see, are observed, upon couching the Cataracts, to see every Thing in its natural Situation, without the Use of any Feeling, or previous Experiences.

One Thing, which imposes upon the Mind, is, the Continuance which external Sensations make, during almost the Space of a Second of Time, after they have been conveyed to the Sensorium by the Eye; whence they are represented to the Mind as Objects really present.

From hence proceeds the Idea of a fiery Circle from the Circumrotation of a lucid Body; and hence proceeds the Continuance of a shining Image of the Sun, and sometimes of other Bodies, after they have been viewed by the Eye.

If it be questioned, Whether it be true, that the Object is painted upon the Retina? or whether this painted Image be not made upon the Choroides? or whether this new Opinion be not confirmed by the Experiment which shews that Part of the Eye to be blind, or insensible, where the Optic Nerve enters into it? And whether this is not explainable; because, no Choroides being there, the naked Retina is incapable of seeing? We answer, That this late Supposition is inconsistent with known Observations, by which the Retina is evidently a most sensible Expansion of the Nerve, while the Choroides has only a few Nerves, with small Vessels, which are certainly blind.

It is also opposed by the great Variety of the Choroides in different Animals, while the constant Uniformity of the Retina is equally as remarkable; to which add, the black Membrane which is interposed betwixt the Retina and Choroides in some Kinds of Fish.

Finally; Anatomy demonstrates, that the Choroides is seated in the blind Part of the Eye, but a white Colour: Moreover, from this Experiment we have a Reason, why the Optic Nerve is inserted on one Side, and not in the Optic Axis, of the Eye. For thus, excepting one Instance, when there is any Object in the Intersection of Lines drawn through the Center of the Optic Nerves, it is always seen by one Eye, that it may be able to assist the other, whose blind Part is turned towards the Object.

Whether we can see but one Object distinctly at a Time, and that placed directly before the Retina of the Eye that sees distinctly? and whether the Mind persuades herself that she sees many Objects, partly from the Continuance of the Ideas they excite, and partly from the Celerity of the Motion in the Eye? We answer in the Affirmative, with respect to distinct Vision; but it would be too much to assert this with respect to indistinct Vision.

If it be demanded whence proceeds the Blindness which happens to some in the Day-time, and to others in the Night? We answer, That the nocturnal Blindness is familiar to many Countries in the hottest Climates, and to old People who live under a very hot Sun; but the diurnal Blindness is familiar to those who have inflamed Eyes, and to young Persons of an inflamed Habit; whose Eyes are, therefore, extremely tender. Thus one is produced from too great a Tenderness of the Retina, as the other proceeds from a Hardness or Insensibility of it.

Whence proceeds the nocturnal Sight of Animals? From a large dilatable Pupil, a tender Retina, and from a shining Choroides; strongly reflecting the Light.

Whence

Whence is it, that we are blinded, by passing from a light into a dark Place? Because the Optic Nerve, having suffered the Action of stronger Causes, is, for the present, less affected or moved by weaker Causes.

Whence have we Pain, by passing suddenly from a dark Place into the Light? Because the Pupil, being widely dilated in the Dark, suddenly admits too great a Quantity of Light before it can contract; whence the tender Retina, which is easily affected by a small Light, feels, for a Time, an Impression too sharp or strong.

Whether we see with one Eye, or both? Frequently with one, and especially the right Eye; but when both are employed together, we see more Objects, and plainer; and we also distinguish more Points of the same Object, and judge better of their Distances. HALLER. Prim. Lin. Physiolog.

OBSERVATIONS.

Physiologists are divided, in their Opinions, concerning the principal Organ of Vision. Some pretend, that the Retina receives the Impression of Light reflected from luminous Objects, which is transmitted, by means of its Fibres, to the Sensorium.

MARIOTTE, and several others, say, that the Choroides receives the Impression; and that the nervous Filaments of this Membrane, which they look upon as an Expansion of the Pia Mater, convey it afterwards to their Origin.

In the Practice of the Diseases of the Eyes I have made some particular Discoveries concerning Vision: I have found, by a bare Inspection of the Alterations incident to the Sight, that the Retina is not its principal Organ; that it only serves to modify the Passage of the Rays of Light, which

make their Impression on the Choroides; from whence, by means of the nervous Filaments, it is continued to the Brain. This Reason seems to determine MARIOTTE's Opinion to be the best, tho' it is not followed by many Physiologists. The Proofs he has offered, in Defence of his Opinion, were not sufficient to convince the Judicious of its Truth. His Opponent, PAQUET, has offered very weak and doubtful Reasons.

I have found, by a great Number of Observations, that the different Degrees of Weakness of Sight were always attended with a like Degree of Weakness in the Movement of the Iris; so that, by an Inspection of the Movement of the Iris, I was able to judge, for the most Part, infallibly of the Degree of Sight, even before the Patient told me. Besides, I have remarked, when the Sight is entirely lost, that the Iris remains either dilated, or contracted, without any apparent Movement, in all Degrees of Light.

In order to discover the Truth of one of these Opinions, concerning the principal Organ of Sight, I thought these practical Remarks were not sufficient to clear this Point, without adding some physical Experiments and Observations on the Structure of the Parts; wherefore I made Choice of the following Experiment.

Let an Eye be taken, and, after you have stripped from the posterior Part of the Globe, just at the Entrance of the Optic Nerve, all the Integuments of the Choroides, still taking Care to preserve that Membrane entire; if, then, a lighted Wax Candle be placed in a dark Room before the Pupil of that Eye, the Image of the Candle will appear inverted on the Choroides. Afterwards, if the Choroides be taken off, without damaging the Retina, and the Light be placed as before; it will appear projected on an oiled Paper about two

Lines.

Lines Distance beyond the Retina. Though this Experiment be very simple, it seems to prove, that the Choroides is the principal Organ of Vision; and that the Retina, by reason of its Transparency, serves only to modify the Pencils of the Rays of Light, which pass through that Membrane.

For which Reason, the Retina may be compared to a Glass, through which the Light only passes; and the Choroides to the Quicksilver of a Looking-glass, which receives the Images of Objects that pass through the Glass, and by which the Representation of Objects is made. The subsequent Discovery, which shews a close Union between the Choroides and the Optic Nerve, corroborates my Opinion: If the Optic Nerve be severed in two, together with the Membranes of the Globe; the Choroides will appear, as it were, lodged in the Optic Nerve, about the Origin of the Retina, by very fine Lays, which are intermixed with the Substance of the Optic Nerve; as may be distinguished from their different Colours.

This is more clearly seen in the Eye of an Ox than in that of a Man, or a Horse. In that of an Ox the Traces of the Substance of the Choroides may be perceived in the Substance of the Cornea Opaca.

Besides, as I am assured, the Light, which makes its Impressions on the Choroides, is likewise the Cause of the Contraction and Dilatation of the Iris; I judged this two-fold Action could not be performed but by some nervous Filaments which communicate with the Choroides and Iris: This engaged me to examine, with Care, the nervous Filaments sent off by the little lenticular Ganglion formed by the Union of a Branch of the third Pair and a Branch of the fifth Pair of Nerves. This Ganglion affords several nervous

Filaments which creep about the Optic Nerve; afterwards they pierce the Cornea Opaca, and glide between this Membrane and the Choroïdes; but, before they are distributed to the Iris, they are divided into several Filaments, some of which are lost in the Iris, and some in the Choroïdes, where they disappear; in the same Manner the cutaneous Nerves are hid in the Skin.

This Distribution of the Nerves, joined to the Knowledge I have of the Movements of the Iris, induced me to think that the Choroïdes is the principal Organ which receives the Impression of the luminous Rays reflected from Objects; and their Images are projected on that Membrane in the Manner I have explained.

I take the Retina to be a sort of Epidermis, which modifies this Impression, and, as it were, deadens the Violence of it; and, without this Membrane, the same Uneasiness would affect the Organ of Sight, as would happen to those of the Touch, Smell, or Taste, were they deprived of the uniform Membrane which covers them. In short, the Texture of the Retina seems to declare its Use; for it is transparent, softish, and the Sight passes through it; as appears from the foregoing Experiment.

Hence may be inferred, that this Membrane is no more instrumental to the Sight, than the Epidermis is to the Skin for the Sense of Feeling: Besides, as the Retina is entirely composed of the medullary Substance of the Optic Nerve, there is Reason to presume, that, on account of its Softness, it is incapable of transmitting the Impression of the luminous Rays to the Brain.

My Sentiment of Vision is chiefly founded on this Correspondence of Light with the Movement of the Iris. Indeed these different Motions of the Iris, proportioned to the Strength or Weakness
of

of the Light, seem to depend on the different Impressions which the luminous Rays make on the Choroides, these Impressions, at the same Time, shake the nervous Filaments of the little Ganglion formed from the third and fifth Pairs of Nerves, which, as they pass to the Iris, send off Branches to the Choroides; so that, according to the Force or Weakness of the Impression made by the Sight of the Choroides, at the same Time a like Motion is excited in the Fibres of the Iris, viz. in the Radial, which dilate the Pupil, or in the circular, to contract the same. Hence it is manifest, as the Retina has no Communication with the Iris, by which these different Motions might be produced, it must yield this Perfection to the Choroides, of which the Iris is a Production.

In short, the various Observations I have made of the Motion of the Iris, have determined me to lay down Rules by which the Strength, Weakness, or total Loss of the Sight, may be known: For the Eyes are often subject to Diseases scarcely perceptible; and the diseased Eye looks as well as a sound one. In order to examine and distinguish one from the other, use the following Method: Let the Patient shut both his Eyes; then, with your Thumb, rub round the superior Part of one of the Lids; afterwards, let that Eye be opened, and exposed to the Light; then examine whether the Iris be endued with its elastic Motion of dilating or contracting the Pupil, and to what Degree; if, for Instance, to a fourth Part, to one Half, or whether it has any Motion at all: Let the Eye, thus examined, be shut, and the other opened, and examined in the same Manner: When the Iris has but a fourth Part of its contractile Motion, the Eye has but a fourth Part of its Sight; if the Iris has one Half of its Motion, then the Eye has one Half of its visive Faculty;
if

if the Pupil is altogether dilated, and the Iris is quite deprived of its contractile Motion, the Sight of that Eye is commonly lost. The contrary Case requires another Rule; viz. if the Pupil is contracted, and, after you have examined the Eye in the preceding Manner, no Motion is perceived in the Iris; this Case is opposite to the former, in which the Dilatation of the Pupil was considered.

The Sight is alike lost in the Contraction of the Pupil, as in the Dilatation; and the Strength or Weakness of the Sight is determined by the Motion of the Iris, in the last Case, with equal Certainty as in the prior.

Observe, when I speak of the Contraction of the Pupil, I do not mean that it is entirely shut, but only in Part closed.

These different States of the Iris are occasioned by a sort of Palsy in its Muscles. The excessive Dilatation proceeds from a Palsy of the circular muscular Fibres, the extraordinary Contraction is caused by a Palsy in the radial muscular ones.

The general Course of these Palsies must be deduced from an Obstruction in the Nerves of the Choroides, which, by their Communication with the Nerves of the Muscles, produce their Motion. It happens, tho' seldom, that the Pupil is almost deprived of any Motion, either of Contraction or Dilatation, whilst the Sight, tho' weak, still remains. In this Case, it is to be observed, that there is a Palsy in the nervous Filaments of the Iris; and that the Impression of the Object is conveyed to the Optic Nerve by means of its close Union with the Choroides.

I have always remarked, that the Palsy of the Choroides is attended with that of the Iris; and that the Palsy of the nervous Fibrillæ of the Iris does not damage the Choroides, tho' it weakens the

the Sight, which seems to be occasioned from the too great Dilatation or Contraction of the Pupil, which, by admitting either too many or too few Rays, renders the Sight imperfect.

Vision is commonly distinguished into three Sorts; viz. the good Sight, that of the Myopes, and that of the Presbytae.

Vision is said to be good, when the Person can see to read at a Foot Distance; in the Sight the Crystalline is perfect, distant Objects are distinctly seen: This Species of Vision has three Degrees, or Foci; the first is at Half a Foot, the second at a Foot Distance, and the third a little farther.

The Sight of the Myopes has a very short Focus; they see distinctly when the Object is near, but confusedly when it is at a greater Distance, and when the Object is at any considerable Distance they cannot see it at all. They require but a little Light to read. This Defect of Sight is attributed to the Crystalline's being too convex.

The Myopes have three Degrees, or Foci: Some cannot read without holding the Object to their Noses; others hold it two or three Fingers Breadth farther; and there is a third Sort who hold the Object at Half a Foot Distance, and even more.

The Myopes must use concave Glasses, in order to see distinctly.

The Presbytae have their Focus very long. They see distinctly when the Object is at a Distance, and confusedly when it is near. This Defect is thought to proceed from the too great Flatness of the Crystalline. It has likewise three Degrees: The first is at a Foot and a Half Distance, the second at two and a Half, and the third still farther. They cannot read without Spectacles when the Object is near. Old People are subject to this Disease. It is quite opposite to that of Myopes, who

who see well near, and confusedly when the Object is far off.

Of these three Sorts of Vision, there are two which admit of a Change: The good is sometimes changed to that of Myopes, especially in Persons who read much, or apply themselves to very fine Work; and sometimes, in old People, it changes to that of Presbytæ.

The Sight of Myopes never varies; that of Presbytæ sometimes becomes good. These different Variations proceed from the different Alterations in the Convexity of the Crystalline.

When the nutritious Juice, necessary to maintain the Convexity of the Crystalline, is of a sufficient Fluidity to pass to the Extremities of the most delicate Vessels of that Humour, then the Convexity is exact; but if this Juice be too thick, it cannot enter those Vessels in a sufficient Quantity: For which Reason, the Crystalline will become flat, in Proportion to the different Tenacity of the said Juice. See SAINT YVES on the Eyes.

What follows is an Account of Observations, made by a young Gentleman who was born blind, or lost his Sight so early that he had no Remembrance of ever having seen, and was couched between Thirteen and Fourteen Years of Age.

Tho' we say of this Gentleman, that he was blind, as we do of all People who have ripe Cataracts; yet they are never so blind, from that Cause, but they can discern Day from Night; and, for the most Part, in a strong Light, distinguish Black, White, and Scarlet: But they cannot perceive the Shape of any Thing. For the Sight, by which these Perceptions are made, being let in obliquely thro' the aqueous Humour, or the anterior Surface of the Crystalline, by which the Rays cannot be brought to a Focus upon the Retina;

tina; they can discern in no other Manner than a sound Eye can through a Glass of broken Jelly; where a great Variety of Surfaces so differently refract the Light, that the several distinct Pencils of Rays cannot be collected, by the Eye, into their proper Foci: Wherefore the Shape of an Object, in such a Case, cannot be at all discerned, tho' the Colour may.

And thus it was with the young Gentleman; who, tho' he knew these Colours asunder in a good Light; yet, when he saw them after he was couched, the faint Ideas he had of them before were not sufficient for him to know them by afterwards: And therefore he did not think them the same which he had before known by those Names.

Now Scarlet he thought the most beautiful of all Colours; and, of others, the most gay were the most pleasing: Whereas the first Time that he saw Black, it gave him great Uneasiness; yet, after a little Time, he was reconciled to it: But, some Months after, seeing, by Accident, a Negro Woman, he was struck with great Horror.

When he first saw, he was so far from making any Judgment about Distances, that he thought all Objects whatever touched his Eyes (as he expresses it) as what he felt did his Skin, and thought no Objects so agreeable as those which were smooth and regular, tho' he could form no Judgment of their Shape, or guess what it was in any Object that was pleasing to him.

He knew not the Shape of any Thing, nor any one Thing from another, however different in Shape or Magnitude; but, upon being told what Things were whose Form he before knew, from Feeling; he would carefully observe, that he might know them again. But having too many Objects to learn at once, he forgot many of them;
and

and (as he said) at first he learned to know, and again forgot, a Thousand Things in a Day.

One Particular only, tho' it may appear trifling, I will relate. Having often forgot which was the Cat, and which the Dog, he was ashamed to ask; but catching the Cat, which he knew by Feeling, he was observed to look at her stedfastly; and then, setting her down, said, So Puss; I shall know you another Time.

He was very much surpris'd, that those Things which he had liked best did not appear most agreeable to his Eyes; expecting that those Persons would appear most beautiful that he loved most; and such Things to be most agreeable to his Sight that were so to his Taste.

We thought he soon knew what Pictures represented, which were shew'd to him; but we found, afterwards, that we were mistaken: For, about two Months after he was couched, he discovered, at once, that they represented solid Bodies; when, to that Time, he considered them only as coloured Planes or Surfaces diversified with Variety of Paint. But even then he was no less surpris'd, expecting the Pictures would feel like the Things they represented; and was amazed when he found those Parts which, by their Light and Shadow, appeared now round and uneven, felt only flat like the rest; and asked which was the lying Sense, Feeling or Seeing.

Being shewn his Father's Picture in a Locket at his Mother's Watch, and told what it was; he acknowledged a Likeness, but was vastly surpris'd; asking how it could be, that a large Face could be express'd on so little Room: Saying, it should have seem'd as impossible to him, as to put a Bushel of any Thing into a Pint.

At first he could bear but very little Sight, and the Things he saw he thought extremely large ; but, upon seeing Things larger, those first seen he conceived less ; never being able to imagine any Lines beyond the Bounds he saw. The Room he was in, he said, he knew to be but Part of the House ; yet he could not conceive that the whole House could look bigger.

Before he was couched, he expected little Advantage from Seeing, worth undergoing an Operation for, except Reading and Writing : For he said, he thought he could have no more Pleasure in walking Abroad, than he had in the Garden, which he could do safely and readily. And even Blindness, he observed, had this Advantage ; that he could go any-where in the Dark, much better than those who can see ; and after he had seen, he did not soon lose this Quality, nor desire a Light to go about the House in the Night.

He said, every new Object was a new Delight ; and the Pleasure was so great, that he wanted Words to express it : But his Gratitude to his Operator he could not conceal ; never seeing him, for some Time, without Tears of Joy in his Eyes, and other Marks of Affection : And if he did not happen to come, at any Time, when he was expected, he would be so grieved, that he could not forbear crying at his Disappointment.

A Year after first seeing, being carried upon EPSOM Downs, and observing a large Prospect ; he was exceedingly delighted with it, and called it a new Kind of Seeing : And now, being lately couched in his other Eye, he says, that Objects first appeared large to his Eye, but not so large as they did at first to the other ; and looking upon the same Object with both Eyes, he thought it looked about twice as large as with the first couched Eye only, but not double, that we can discover.

I have couched several others who were born blind, whose Observations were of the same Kind; but they being younger, none of them gave so full an Account as this Gentleman. CHESELDEN'S Anatomy.

M. DAVIEL's has found out a new Method to cure Cataracts by cutting through the Cornea, and letting out the crystalline Humour. See the Memoires de l'Acad. Royal de Chirurgie, Tom. Seconde; or Mr. WARNER's Chirurgical Cases; wherein there is an Abstract of it, somewhat improved by him.





LECTURE VII.

Of the BRAIN, and its Appendages.

THE Name of BRAIN is given to all that Mass which fills the Cavity of the Cranium, and which is immediately surrounded by two Membranes called MENINGES by the Greeks, and MATRES by other Antients; because they were commonly of Opinion, that these Membranes were the Origin, and, as it were, the Mother of all the other Membranes of the Body.

This general Mass is divided into three particular Portions: The CEREBRUM, or BRAIN, properly so called; the CEREBELLUM, and MEDULLA OBLONGATA. To these three Parts, contained within the Cranium, a fourth is added, which fills the great Canal of the Spina Dorſi, by the Name of MEDULLA SPINALIS, being a Continuation of the Medulla Oblongata.

The Meninges, or Membranes, are two in Number; one of which is very strong, and lies contiguous to the Cranium; the other very thin, and immediately touches the Brain. The first is named DURA MATER, the second PIA MATER; which is again divided into two, the external Lamina being termed ARACHNOÏDES, the internal retaining the common Name of PIA MATER.

The DURA MATER incloses the Brain and all its Appendages: It lines the internal Side of the

Cranium, and supplies the Place of an internal Periosteum; being spread in all the Apertures and Depressions, and covering all the Eminences in such a Manner as to prevent their being hurtful to the Brain.

It is composed of two Laminæ, adhering very closely together, the Fibres of both crossing each other obliquely. By rubbing any Part of this Membrane between the Fingers, we easily perceive the two Laminæ sliding a little upon each other. Their Texture is very close and strong; appearing to be partly ligamentary, and partly tendinous.

It sticks closely to the Cranium by a great Number of Filaments of the external Lamina, which enter the Pores of the Bones chiefly at the Sutures both above and below; and, by penetrating these Joints, they communicate with the external Periosteum. These Filaments are, for the most part, small Vessels; which being broken, in separating the Dura Mater from the Cranium, a great Number of red Points appear on the external Surface of that Membrane.

It adheres much more to the whole internal Surface of the Cranium in Children and young Persons, than in those of an advanced Age; the Filaments, becoming then very small, being compressed by the Contraction of the osseous Pores; and, consequently, are more easily ruptured by any Force applied to them.

These Adhesions are formed entirely by the external Lamina. The internal Lamina is very smooth and polished on the Inside, which is also continually moistened by a fine Fluid discharged thro' its Pores, much in the same Manner as in the Peritonæum and Pleura.

The Plicæ of the Dura Mater are made by the internal Lamina; and three of them form particular

cular Septa; one of which is superior, representing a kind of *Mediaſtinum* between the two great Lobes of the Brain; the second is in a middle Situation, like a *Diaphragm* between the *Cerebrum* and *Cerebellum*; the third is inferior between the Lobes of the *Cerebellum*. The superior Septum is longitudinal in Form of a *Scythe*, whence it is termed the *Falx* of the *Dura Mater*; and it may likewise be called *Septum Sagittale*, *Verticale*, or *Mediaſtinum Cerebri*: The middle Septum is transverse, and might be called the Floor of the *Cerebrum*, *Diaphragm* of the Brain, or Tent of the *Cerebellum*: The inferior Septum is very small, and descends between the Lobes of the *Cerebellum*; on account of which it may be termed either simply *Septum Cerebelli*, or *Septum Occipitale Minus*; the middle Partition being looked upon as the *Septum Occipitale Majus*.

The superior or vertical Septum, called the *Falx* of the *Dura Mater*, is a long and broad Fold or Duplicature of the internal *Lamina*, reaching from the Margin of the *Crista Offis Cribrosi*, along the sagittal Suture, to the Middle of the transverse Septum, which it joins in such a Manner, as that the lateral *Laminæ* of the *Falx* are continuous on each Side with the adjacent Portions of the superior *Laminæ* of the middle Septum.

It is broader where it joins the middle Septum than at the *Os Ethmoides*, and is thicker at that Margin which adheres to the *Cranium* than at the other, which lies loose, and is very sharp; and from this Resemblance to a *Scythe*, it had the Name of *Falx*.

The transverse or middle Septum is fixed to the *Os Occipitis* along the Grooves of the lateral Sinuses, and those of the great Angles of the *Apophyses Petrosæ* all the way to the posterior clinoid *Apophyses* of the *Os Sphenoid*. By this Situa-

tion it forms a sort of Floor, Tent, or shallow Vault, on the anterior Part of which is a large Fissure almost of an oval Figure.

This Septum divides the Cranium into two Cavities; one large, or superior; and the other small, or inferior; which communicate by the great oval Fissure. It is formed by a particular Plicā and a very broad Membrane of the internal Lamina of the Dura Mater; and, in its natural State, it is very tense, because of its Union, or rather Continuity, with the Falx.

This Union or Continuity keeps them both very tense; so that the middle Septum is capable of sustaining a considerable Weight without sinking; and the Falx is able to resist lateral Pressures without giving way either to the Right or Left.

We may be convinced of this reciprocal Tension by first touching these two Septa in their natural State, and again after they have been cut one after the other according to their Breadth, or rather after having cut, in this Manner, the Falx in one Subject, and the transverse Septum in another; for, as soon as the Falx is cut, the other will be perceived immediately to lose its Tension and Firmness: And the same Thing will be observed in the Falx, as soon as we cut the Septum Medium.

The small occipital Septum is very short and narrow. It descends from the Middle of the transverse Septum to the Margin of the great occipital Foramen, being fixed to the internal Spine of the Os Occipitis. It is formed by a Fold and Duplicature of the internal Lamina of the Dura Mater, in the same Manner as the other two, and distinguishes the inferior Part of the occipital Cavity of the Cranium into two lateral Parts. In some Subjects this Septum is double, answering to the double Spine of the Os Occipitis.

Besides these large Plicæ, there are two small lateral ones on each Side of the Sella Sphenoïdalis, each running from the posterior to the anterior clynoïd Apophysis on the same Side. These two Plicæ, together with the anterior and posterior Parts of the Sella Sphenoïdalis, form a small Fossula in which the pituitary Gland is lodged: There are likewise two anterior Plicæ at the Margins of the sphenoid or superior orbitary Fissures, which augment the Depth of the middle Fossulæ of the Basis Cranii. Thus we have seven Plicæ of the internal Lamina of this Membrane, three large, and four small; which may be termed internal Productions or Processes of the Dura Mater.

The Elongations of the Dura Mater are Productions of both Laminæ which go beyond the general Circumference and pass out of the Cranium thro' the Foraminæ described in the Treatise of the Skeleton; and in this they differ from the Plicæ that are formed entirely by one Lamina, and do not go out of the Cranium. They may be named the external Productions of the Dura Mater.

The most considerable of these Elongations passes thro' the great occipital Foramen, and runs down the common Canal of the Vertebræ in Form of a Tube, lining the internal Side of that Canal, and inclosing the Medulla Spinalis, by the Name of the Dura Mater of that Medulla: The other Elongations accompany the Nerves out of the Cranium in Form of Vaginæ, which are more numerous than the nervous Trunks reckoned in Pairs. For the olfactory Nerves, there is the same Number of distinct Vaginæ as there are Foraminæ in the Lamina Ethmoïdalis; and some Nerves are accompanied by several Vaginæ thro' one Foramina, as those of the ninth Pair.

There are two particular Elongations which form the Periofteum of the Orbits, together with the Vaginæ of the Optic Nerves; thefe orbitary Elongations egress by the fphenoid or fuperior orbitary Fiffures, and, increafing in Breadth in their Paffage, line the whole Cavity of the Orbits, at the Margins of which they communicate with the Pericranium and Periofteum of the Face. They communicate, likewise, thro' the Sphenomaxillary or inferior orbitary Fiffures, with the Pericranium of the Temporal and Zygomatic Foffæ; and by thefe Communications we may explain the Accidents which happen to thefe Parts in Wounds of the Head.

The Elongations of the Dura Mater that accompany the fanguiferous Veffels thro' the Foramina of the Cranium, unite with the Pericranium immediately afterwards. Such, for inftance, are the Elongations that line the Foffulæ of the Foramina Lacera or Jugularia, and the offeous or carotid Canals of the Apophyfis Petrofa, &c.

The Veffels of the Dura Mater are, Arteries, Veins, and Sinufes. The Arteries, in general, are diftinguifhed into anterior, middle, and pofterior; and come from the Carotides and Vertebrales on each Side. The external Carotid fends a Branch thro' the fpinal Foramina of the Os Sphenoid, which is the middle Artery of the Dura Mater, and is called, by way of Eminence, Arteria Duræ Matris. It is divided into a great Number of Rami, which are plentifully difperfed, thro' the Substance of the external Lamina, as high as the Falx, where thefe Ramifications communicate with their Fellows from the other Side. The Impreffions of this Artery are feen on the internal Side of the parietal Bones, the anterior and inferior Angle of which, inftead of a fimple Impreffion, contains a Canal for the Paffage of a
Trunk

Trunk or Branch of this Artery, on account of which several Accidents happen in Fractures of the Cranium.

The external Carotid sends another small Ramus thro' the Corner or small End of the sphenoid or superior orbitary Fissure, where there is sometimes a little Fissure on Purpose, mentioned in the Description of the Skeleton: This Ramus is the anterior Artery of the Dura Mater, and gives off Ramifications, in the same Manner as the former, with which it communicates; but they are not so numerous. The internal Carotid, as it enters the Cranium, gives off a small Ramus to the Substance of the Dura Mater.

The two vertebral Arteries enter by the great occipital Foramen, and unite, in one Trunk, on the anterior or sphenoid Apophysis of the Os Occipitis; immediately afterwards they enter the Substance of the Dura Mater on both Sides, each of them by one or two Rami; these are the posterior Arteries of the Dura Mater; and they communicate, by some Ramifications, with the middle or spinal Artery above mentioned.

The Dura Mater contains, in its Duplicature, several particular Canals, into which the venal Blood, not only of that Membrane, but of the whole Brain, is carried: These Canals are termed Sinuses; and some of them are disposed in Pairs, others in uneven Numbers: That is, some of them are placed alone, in a middle Situation; others are disposed laterally on each Side of the Brain. The most antient Anatomists reckoned only four; to which we can now add four Times as many.

These Sinuses are in the Duplicature of the Dura Mater; and their Cavities are lined, on the internal Side, by particular very fine Membranes. They may be enumerated in this Manner.

The great Sinus of the Falx or superior longitudinal Sinus, which was reckoned the first by the Antients.

Two great lateral Sinuses, the second and third of the Antients.

The Sinus called Torcular Herophili, the fourth of the Antients.

The small Sinus of the Falx or inferior longitudinal Sinus.

The posterior occipital Sinus, which is sometimes double.

Two inferior occipital Sinuses, which form a Portion of a Circle, and may likewise be called the inferior lateral Sinuses.

Six Sinus Petrosi, three on each Side; one anterior, one middle or angular, and one inferior. The two inferior, together with the occipital Sinuses, complete a circular Sinus round the great Foramen of the Os Occipitis.

The inferior transverse Sinus.

The superior transverse Sinus.

Two circular Sinuses of the Sella Sphenoïdalis; one superior, and one inferior.

Two Sinus Cavernosi, one on each Side.

Two orbitary Sinuses, one on each Side.

All these Sinuses communicate with each other, and with the great lateral Sinuses, by which they discharge themselves into the internal jugular Veins, which are only Continuations of these lateral Sinuses: They likewise exonerate themselves partly into the vertebral Veins, which communicate with the small lateral or inferior occipital Sinuses, and partly into the external jugular Veins, by the orbitary Sinuses, which communicate with the Venæ Angulares, Frontales, Nasales, Maxillares, &c. as the lateral Sinuses likewise communicate with the Venæ Occipitales, &c.

Thus

Thus the Blood, that is carried to the Dura Mater, &c. by the external and internal Carotids and vertebral Arteries, is returned to the Heart by the external and internal jugular and vertebral Veins; so that, when the Passage of the Blood is obstructed in any particular Place, it finds another Way by means of these Communications, tho' not with the same Ease. This Observation is of Consequence in relation not only to Obstructions, but to the different Situations of the Head.

The great Sinus of the Falx reaches from the Connexion of the ethmoid Crista with the Os Frontis, along the superior Margin of the Falx, all the way to the posterior Margin of the transverse Septum, where it terminates, by a Bifurcation, in the great lateral Sinuses. It is very narrow at its anterior Extremity, and from thence becomes gradually wider all the way to its posterior Extremity.

The Cavity of this Sinus is not cylindrical, but triangular, having, in a Manner, three Sides; one superior, parallel to the Cranium; and two lateral, inclined to the Plane of the Falx. The superior Side is formed by the external Lamina of the Dura Mater; and thro' the Middle of its Breadth a kind of fine Raphe, or Suture, runs from one End to the other.

The two inferior Sides are Productions of the internal Lamina, which, having parted from the external, are inclined towards each other, and then unite; first forming the Sinus, and afterwards the Duplicature of the Falx. This Sinus is lined interiorly by a fine proper Membrane, which forms, likewise, a kind of Raphe, or Suture, along the Bottom of the Sinus, that is, along the Union of the two Sides.

In this Sinus we observe several Foraminæ and ligamentary Fræna. The Foraminæ are Orifices
of

of Veins, the smallest of which belong to the Dura Mater, the largest to the Brain. The Veins of the Brain enter the Sinus, for the most part, obliquely from behind anteriorly, after they have run about a Finger's Breadth in the Duplicature of the Dura Mater.

It has been thought, that the Arteries of the Dura Mater discharged themselves immediately into the Sinuses; because Injections, made by the Arteries, or a Hog's Bristle thrust into them, have been found to pass into these Sinuses: But, on a more close Examination, it has been discovered, that the Injections passed from the Arteries into the Veins, and from thence into the Sinuses, thro' the small Orifices already mentioned; and that the Hog's Bristle pierced the Sides of the Artery, which, near the Sinuses, are very thin.

This Mistake gave Rise to another; that the Dura Mater had no Veins: And what confirmed it was, that the Arteries of the Dura Mater cover the Veins so entirely, that the Margins of the Veins are hardly perceptible on either Side of the Arteries. There are, however, some Places where the Veins, being broader than the Arteries, their two Margins are seen on each Side of the Arteries like capillary Vessels. These Veins are, for the most part, Rami of the Sinuses, and the small Trunks of some of them open into the Head of the Vena Jugularis Interna. We may easily be satisfied that the Arteries, on both Sides of the Dura Mater, communicate with each other above the Falx, either by injecting or blowing into them.

The internal Fræna of this great Sinus appear to be tendinous, and to be designed to prevent the too great Dilatation of the Sinus by the Blood. They vary, however, in different Subjects, and do not always reach from one Side to the other. It
has

has been pretended, that Glands have been found there; but we ought to take Care not to mistake for such, certain small Corpuscles which are the Products of Diseases.

The inferior Sinus of the Falx is situated in the inferior Margin of its Duplitecture, being very narrow, and, as it were, flattened on both Sides: It communicates immediately with the fourth Sinus of the Antients; and, in some Subjects, seems even to be a Continuation thereof. It likewise communicates with the great or superior Sinus, by small Veins which go from one to the other, and with the Veins of the Cerebrum by the same Means.

The lateral Sinuses represent two large Rami of the superior longitudinal Sinus, one going to the right Hand, the other to the left, along the great Circumference of the transverse Septum, all the way to the Basis of the Apophysis Petrosa of the Ossa Temporum; from thence they descend, having first taken a large Turn, and then a small one; and, being strongly fixed in the lateral Sinuses of the Basis Cranii, they follow the Course thereof all the way to the Foramina Lacera and Fossulæ of the jugular Veins.

They do not always arise by an equal and symmetrical Bifurcation of the superior longitudinal Sinus; for, in some Subjects, one of the lateral Sinuses appears to be a Continuation of the longitudinal, and the other a Branch from it. This Variety may happen on either Side; and, in short, we sometimes find one of these Sinuses higher or lower, larger or smaller, than the other.

The Cavity of these lateral Sinuses is likewise triangular, and furnished with a proper Membrane and Fræna; and it has also the small venal Foramina, which indeed are common to it, not
only

only with the longitudinal Sinus, but with most part of the others. The posterior or external Side of this Cavity is formed by the external Lamina of the Dura Mater, and the other two by the internal one.

As these two Sinuses egress by the posterior Portions of the Openings of the Basis Cranii called Foramina Lacera, they are dilated into a kind of Bag, proportioned to the Fossulæ of the Venæ Jugulares, where they terminate in these Veins.

Near the Concourse of the superior longitudinal and lateral Sinuses we observe an Opening (sometimes double) which is the Orifice of a Sinus situated along the Union of the Falx and transverse Septum: It does not always terminate directly at the inferior Part of the superior Sinus, but sometimes opens at the Beginning of one of the lateral Sinuses, especially when the Bifurcation is not equal; and, in this Case, it often terminates in that lateral Sinus, which appears like a Branch from the common Trunk of the superior and other lateral Sinus.

This Sinus has been named Torcular Herophili, from an antient Author, who imagined that the Blood was, in a Manner, in a Press, at the Union of these four Sinuses: Its Diameter is but small, and it forms a kind of Bifurcation with the inferior longitudinal Sinus, and with a Vein of the Cerebrum, which is sometimes double, called Vena Magna Galeni.

The cavernous or lateral Sinuses of the Os Sphenoides are Reservatories, of a very particular Kind, containing not only Blood, but considerable Vessels and Nerves; and likewise a spongy or cavernous Substance, full of Blood, much like that of the Spleen or Corpus Cavernosum of the Urethra.

We observe some nervous Filaments which go to the Dura Mater, from the Trunk of the fifth Pair, at the Entry of the cavernous Sinus; and from the common Trunk of the eighth Pair and Nervus Accessorius, or Spinalis, as they pass thro' the Foramen Lacerum. The small Tubercles, sometimes found on the lateral Parts of the longitudinal Sinus of the Falx, deserve to be examined before any Thing can be determined about them. All the Inside of the Dura Mater is moistened in the same Manner as the Peritoneum and Pleura.

The prominent Fibres, intersecting each other in different Manners, which appear internally on the Dura Mater, especially near the Falx and transverse Septum, and which have been taken for a kind of musculous Fibres, seem to be only ligamentary and elastic. The universal Adhesion of this Membrane to the Cranium proves that it can have no particular Motion, and, consequently, that such musculous Fibres would be altogether useless.

The PIA MATER surrounds the whole Mass of the Brain more particularly than the Dura Mater, and adheres very closely to the Brain, and is connected to the Dura Mater only by the Veins that open into the Sinuses, as has been observed.

It is composed of two very fine Laminæ, the exterior of which covers, pretty uniformly, all the convex Surface of the Brain; and lines, in the same Manner, all the concave or interior Surface of the Dura Mater: The internal Lamina forms a great Number of Plicæ, Duplicatures, and Septa, which insinuate themselves into all the Folds and Circumvolutions, and between the different Strata of the Cerebrum and Cerebellum.

The two Laminæ of the Pia Mater are not so closely united as those of the Dura Mater, being
con-

connected only by a cellulous Substance that accompanies them thro' their whole Extent, except at some Places of the Basis of the Cerebrum, &c. where the internal Lamina continuing its Infections, the external remains uniformly stretched over the prominent Parts, the Interstices of which are entirely separated from the other Lamina, without any cellular Substance between them. These separate Portions of the external Lamina have made it be looked upon as a third Membrane of the Brain distinct from the Pia Mater; and it has been named *Membrana Arachnoïdes*, from its Resemblance of a Cobweb in Delicacy of Texture.

In each of these Laminæ of the Pia Mater we discover another kind of fine Duplication, which contains Vessels; but these small Vessels are hardly visible without the Help of an Injection, or a great Inflammation. The cellular Substance not only accompanies the two Laminæ thro' their whole common Extent, in the Manner already said, but also the internal Lamina, in particular, thro' all its Duplicatures and Septa*.

The CEREBRUM, properly so called, is a kind of medullary Mass, of a moderate Consistence, and of a greyish Colour on the external Surface, filling all the superior Portion of the Cavity of the Cranium, or that Portion which lies above the transverse Septum. The superior Part of the Cerebrum is of an oval Figure, like Half an Egg cut longitudinally, or rather like two Quarters of an Egg cut lengthwise, and parted a little from each

* This we discover by blowing through a small Pipe cautiously introduced between the two Laminæ, so as not to offend any of the Parts near it, in the Manner I demonstrated publicly in the Year 1726, in the Dissections which I performed myself at the College of Physicians. WINSLOW.

other. It is flatter on the inferior Part, each lateral Half of which is divided into three Eminences called Lobes; one anterior, one middle, and one posterior.

The Substance of the Cerebrum is of two Kinds, distinguished by two different Colours; one Part of it, which is softest, being of a greyish or ash Colour; the other, which is more solid, being very white. The Ash-coloured Substance lies chiefly on the exterior Part of the Cerebrum like a kind of Cortex, from whence it has been named *Substantia Corticalis*, or *Cinerea*. The white Substance occupies the interior Part, and is named *Substantia Medullaris*, simply *Substantia Alba*.

The Cerebrum is divided into two lateral Portions, separated by the Falx, or great longitudinal Septum of the Dura Mater. They are generally termed Hemispheres; but they are more like Quarters of an oblong Spheroid: Each of these Portions is divided into two Extremities; one anterior, and one posterior; which are termed the Lobes of the Cerebrum, between which there is a large inferior Protuberance, which goes by the same Name: So that, in each Hemisphere, there are three Lobes; one anterior, one middle, and one posterior.

The anterior Lobes lie upon those Parts of the Os Frontis which contribute to the Formation of the Orbits and of the frontal Sinuses, commonly called the anterior Fossæ of the Basis Cranii; the posterior Lobes lie on the transverse Septum, and the middle Lobes in the middle or lateral Fossæ of the Basis Cranii.

Each lateral Portion of the Cerebrum has three Sides: One superior, which is convex; one inferior, which is uneven; and one lateral, which is flat,

flat, and turned to the Falx. Thro' the whole Surface of these three Sides we see Inequalities, or Windings, like the Circumvolutions of Intestines, formed by waving Streaks, or Furrows, very deep and narrow, into which the Septa or Duplicatures of the Pia Mater insinuate themselves, and thereby separate these Circumvolutions from each other.

Near the Surface of the Cerebrum these Circumvolutions are at some Distance from each other, representing serpentine Ridges; and in the Interstices between them the superficial Veins of the Cerebrum are lodged, between the two Laminæ of the Pia Mater, from whence they pass into the Duplicature of the Dura Mater, and so open into the Sinuses.

These Circumvolutions are fixed, thro' their whole Depth, to the Septa or Duplicatures of the Pia Mater, by an infinite Number of very fine vascular Filaments; as may be seen, by pulling the Circumvolutions a little asunder with the Fingers.

When they are cut transversly, we observe, that the Substantia Alba lies in the Middle of each Circumvolution; so that there is the same Number of internal medullary Circumvolutions as of external cortical ones; the first representing white Laminæ invested by others of an ash Colour; but the cortical Substance is, in many Places, thicker than the medullary.

The anterior and middle Lobes of the Cerebrum on each Side are separated by a deep narrow Sulcus, which ascends obliquely backwards from the Temporal Ala of the Os Sphenoïdes to near the Middle of the Os Parietale; and the two Sides of this Division have each their particular Ridges and Circumvolutions, which gives a very great Extent to the cortical Substance. This Sulcus is
termed

termed *Fissura Magna Silvii*; or simply *Fissura Cerebri*.

Having cut off the *Falx* from the *Crista Galli*, and turned it backward; if we separate gently the two lateral Parts or Hemispheres of the *Cerebrum*, we see a longitudinal Portion of a white convex Body, which is named *Corpus Callosum*. It is a middle Portion of the medullary Substance, which under the inferior Sinus of the *Falx*, and also a little towards each Side, is separated from the Mass of the *Cerebrum*, to which it is simply contiguous from one Extremity of that Sinus to the other; so that, at this Place, the Margin of the interior Side of each Hemisphere only lies on the *Corpus Callosum*; much in the same Manner as the anterior and posterior Lobes lie on the *Dura Mater*. Both Extremities of this medullary Body terminate by a small Margin bent transversely downwards.

The Surface of the *Corpus Callosum* is covered by the *Pia Mater*, which runs in between the lateral Portions of this Body and the inferior Margin of each Hemisphere. Along the Middle of its Surface, from one Extremity to the other, there is a kind of Raphe, formed by a particular Intertexture of Fibres which cross each other; for tho' these Fibres appear to be transverse, yet they are really a little oblique; and those that come from the right Side intersect those that come from the left. This Raphe is made more perceptible by two small medullary Rami, which accompany it on each Side, and adhere closely to the transverse Fibres.

The *Corpus Callosum* becomes afterwards continuous, on each Side, with the medullary Substance, which, thro' all the remaining Parts of its Extent, is entirely united with the cortical Substance, and, together with the *Corpus Callosum*,

forms a medullary Arch or Vault of an oblong or oval Figure*.

Under this Curvature are two lateral Cavities, much longer than they are broad, and very shallow, separated by a transparent medullary Septum: These Cavities are generally named the anterior superior Ventricles of the Cerebrum, to distinguish them from two other smaller Cavities which are situated more posteriorly; but the Name of lateral or great Ventricles, given them by STENØ, is more proper than either of the other two.

The lateral Ventricles are broad, and rounded at those Extremities which lie next to the transparent Septum: They go from before posteriorly, contracting in Breadth, and separating gradually in their Progress; afterwards they bend inferiorly, and return obliquely, from behind anteriorly, in a Course like the turning of a Ram's Horn, and terminate almost under their superior Extremities, only a little more posteriorly and externally.

At the Place where they begin to bend, in order to descend and then run posteriorly, there is, on each Side, a particular Elongation, which runs from the anterior to the posterior Part, and terminates in a triangular pointed Cavity turned a little interiorly, the two Points resembling Horns. These Ventricles are every-where lined with a thin Membrane.

* To perceive this, the whole cortical Substance, together with the medullary Laminæ mixed with it, must be cautiously and dexterously cut off in the same Direction with the Convexity of the Cerebrum; after which, we shall observe a medullary Convexity much smaller than that which is common to the whole Cerebrum, but of the same Form: So that it appears like a medullary Nucleus of the Cerebrum, especially when we consider it together with the medullary Substance of the inferior Part or Basis of the Cerebrum. And thence VIEUSSENS took Occasion to name this Nucleus the Centrum Ovale.

The transparent Partition, or Septum Lucidum, as it is commonly called, lies directly under the Raphe or Suture of the Corpus Callosum, of which it is a Continuation, and a kind of Duplication: It is composed of two medullary Laminæ, more or less separated from each other by a narrow medullary Cavity sometimes filled with a serous Substance. This Cavity, in some Subjects, reaches a great way posteriorly, and, it is imagined, communicates with the third Ventricle.

The Septum Lucidum is united, by its inferior Part, to the anterior Portion of that particular medullary Body improperly called the Fornix with three Pillars, because of some Resemblance it is thought to bear to the Arches of antient Vaults. It is, in Reality, nothing but the Corpus Callosum, the inferior Side of which is like a hollow Cieling with three Angles; one anterior, and two posterior; and three Margins, two lateral, and one posterior. The lateral Margins are terminated each by a large semi-cylindrical Border, like two Arches, which, uniting at the anterior Angle, form, by their Union, what is called the anterior Pillar of the Fornix; and as they run backward separately towards the two posterior Angles, they have then the Name of the posterior Pillars.

The anterior Pillar, being double, is larger than either of the posterior; and the Marks of this Duplicity always remain: Immediately below the Basis of this Pillar we observe a large, white, short, medullary Ligament extended transversly between the two Hemispheres, and commonly called the anterior Commissure of the Cerebrum. It is to this Pillar that the Septum Lucidum adheres; but it has no total Adhesion below, and therefore the two lateral Ventricles communicate with each other. The posterior Pillars are bent

inferiorly, and continued thro' the inferior Portions of the Ventricles all the way to their Extremities, resembling a Ram's Horn, which is a Name that has been given them. They diminish gradually in Thickness during this Course, and at their external Sides they have each a small, thin, flat, collateral Border, from which the Name of Corpora Fimbriata is derived.

The inferior Surface of the triangular Cieling which lies between these Arches is full of transverse, prominent, medullary Lines; for which Reason the Antients called it Psalloïdes and Lyra, comparing it to a stringed Instrument, somewhat like what is now called a Dulcimer.

The Fornix being cut off and inverted, or quite removed, we first see a vascular Web called Plexus Choroïdes, and several Eminences more or less covered by the Expansion of that Plexus. There are four Pairs of Eminences which follow each other very regularly, two large, and two small. The first two great Eminences are named Corpora Striata, and the second Thalami Nervorum Opticorum: The four small Eminences are closely united; the anterior being called Nates, and the posterior Testes; but it would be better to call them simply, anterior and posterior Tubercles. Immediately before these Tubercles there is a single Eminence called Glandula Pinealis.

The Corpora Striata got that Name, because, in scraping them with the Knife, we meet with a great Number of white and ash-coloured Lines alternately disposed, which are only the transverse Section of the medullary and cortical Laminæ mixed together, in a vertical Position, in the Basis of the Cerebrum, as appears evidently by Incisions made from above downwards: These two Eminences are of a greyish Colour on the Surface, oblong, roundish, pyriform, and larger on the anterior than

than on the posterior Part, where they are narrow and bent.

They lie on the Basis of the superior Cavity of the lateral Ventricles, which they resemble, in some measure, in Shape; their anterior Parts being near the Septum Lucidum, from which they separate gradually, as they run posteriorly, and diminish in Size. They are, in Reality, the convex Bases of the Ventricles; and it is at the inferior Part of the Interstice between the largest Portions of them that we observe the great transverse Ligament named the anterior Commissure of the Cerebrum (which was mentioned in describing the anterior Column of the Fornix Callosus). This Ligament communicates more particularly with the Basis of the Corpora Striata by a Turn towards each Side.

The Thalami Nervorum Opticorum are so named, because these Nerves arise chiefly from them. They are two large Eminences placed by the Side of each other between the posterior Portions or Extremities of the Corpora Striata: Their Figure is semi-spheroidal and a little oval, and they are of a whitish Colour on the Surface; but their internal Substance is partly greyish, and partly white; so that, in cutting them, we see Streaks of different Colours like those of the Corpora Striata.

These two Eminences are closely connected, and at their convex Part are so far united, as really to become one Body; the whitish external Substance being continued uniformly over them both. This Substance is very thin, and falls to Pieces only by the Weight of the lateral Parts of the Brain, when taken out of the Cranium: Therefore, to learn the Structure of these Eminences, they must be examined in Situ, and even there they must be handled very gently.

Immediately within this whitish common Substance these two Eminences are contiguous till about the Middle of their Thickness, and from thence they separate insensibly towards the Basis; where, by the Space left between them, a particular Canal is formed named the third Ventricle, one Extremity of which opens anteriorly, the other posteriorly. Some Anatomists have mistaken the superficial Connexion of these Eminences for the Pons Varolii.

At the Basis these two Eminences are elongated inferiorly, towards both Sides, into two thick, round, whitish Ligaments, which separate, like Horns, by a large Curvature, and afterwards by a small Curvature turned anteriorly in an opposite Direction to the former, and representing the Apex of a Horn, they approach each other again. The Size of these Ligaments diminishes gradually from their Origin to their anterior Reunion.

The Tubercles are four in Number, two anterior and two posterior, adhering as if they formed one Body situated behind the Union of the Thalami Nervorum Opticorum. They are transversely oblong; the anterior being a little more rounded, and broader or larger from before backwards than the posterior. Their Surface is white, and their internal Substance greyish. The Names of Nates and Testes, given to these Tubercles, are very improper; there being no Resemblance between them and the Things from whence those Names are taken. I should choose to call them Tubercula Quadrigemina.

Directly under the Place where the Tubercles of one Side are united to those of the other, lies a small middle Canal, which communicates, by its anterior Foramina, with the third Ventricle under the Thalami Nervorum Opticorum; and, by its

po-

posterior one, with the fourth Ventricle, which belongs to the Cerebellum.

Where the convex Parts of the two anterior Tubercles join these posterior convex Parts of the Thalami Nervorum Opticorum, an Interstice or Aperture is left, between these four Convexities, which communicates with the third Ventricle and the small middle Canal. Instead of the ridiculous Name of Anus which has been given to this Aperture, it may be called Foramen Commune Posterius, to distinguish it from another which shall be mentioned hereafter by the Name of Foramen Commune Anterius.

The Glandula Pinealis is a small, soft, greyish Body, about the Size of an ordinary Pea, irregularly round, and sometimes of the Figure of a Pine Apple, situated behind the Thalami Nervorum Opticorum, above the Tubercula Quadrigemina. It is fixed, like a small Button, to the inferior Part of the Thalami by two very white medullary Pedunculi, which at the Gland are very near each other, but separate almost transversely towards the Thalami.

It seems to be chiefly of a cortical Substance, except near the Footstalks, where it is somewhat medullary: The Footstalks are sometimes double, as if they belonged to the two anterior Tubercles. This Body adheres very close to the Plexus Choroïdes, by which it is covered, therefore requires some Dexterity to separate it from the Glandula without altering its Situation, or breaking the Pedunculi. Below the Glandula Pinealis there is a medullary transverse Ramus called the posterior Commissure of the Hemispheres of the Cerebrum.

Between the Basis of the anterior Column of the Fornix and the anterior Part of the Union of the Optic Thalami lies a Cavity, or Fossula, named Infundibulum: It descends towards the

Basis of the Cerebrum, contracting gradually, and terminates, in a strait Course, by a small membranous Canal, in a softish Body situated in the Sella Sphenoidalis, named Glandula Pituitaria. The Infundibulum opens superiorly, immediately before the Optic Thalami, by an oval Aperture named Foramen Commune Anterius, and, consequently, communicates with the lateral Ventricles.

At the inferior Part of the Thalami Nervorum Opticorum, directly under their Union, lies a particular natural Canal, called the third Ventricle of the Cerebrum: We call it a natural Canal, that we may not mistake for it an accidental Fissure which lies between the Thalami in Cerebra taken out of the Cranium.

This Canal opens anteriorly into the Infundibulum under the Foramen Commune Anterius, by which it likewise communicates with the lateral Ventricles: It opens posteriorly under the Foramen Commune Posterius, between the Thalami and Tubercula Quadrigemina, opposite to the small middle Canal which goes to the Cerebellum.

The Plexus Choroïdes is a very fine vascular Texture, consisting of a great Number of arterial and venal Ramifications, partly collected in two loose Fasciculi, which lie one in each lateral Ventricle, partly expanded over the circumjacent Parts, and covering, in a particular Manner, the Thalami Nervorum Opticorum, Glandula Pinealis, Tubercula Quadrigemina, and the other adjacent Parts of the Cerebrum and Cerebellum, to all which it adheres.

In each lateral Portion of this Plexus we observe a venal Trunk, the Ramifications of which are expanded through the whole Extent of the two Portions: Near the Glandula Pinealis these two Trunks approach each other, and, uniting behind

behind that Gland; they open into the Torcular or fourth Sinus of the Dura Mater*.

The ventricular or loose Portions of the Plexus often appear to contain a great Number of Tubercles like Glands, which, in the natural State, are extremely small, but, when diseased, grow bigger†.

Besides this vascular Web or Plexus of the Septum Lucidum, the Sides of the Fornix, Eminences, Ventricles, Canals, and Infundibulum, are all covered by a very fine Membrane, in which, by Injections, or Inflammations, we discover a great Number of very fine Vessels. This Membrane is, in a Manner, a Continuation of the Plexus; and that seems to be a Detachment from the Pia Mater: By the same Means we discover an extremely thin Membrane on the internal Sides of the Duplication of the Septum, though, in some Subjects, these Sides touch each other.

The pituitary Gland is a small spongy Body lodged in the Sella Sphenoïdalis between the sphenoid Plicæ of the Dura Mater: It is of a singular Kind of Substance, which seems to be neither medullary nor glandular. On the external Side it is partly greyish and partly reddish, and white within; transversely oval or oblong, and on the inferior Part, in some Subjects, divided by a small Fissure into two Lobes, like a Kidney Bean. It is covered by the Pia Mater as by a Capsula, the Opening of which is the Extremity of the

* When we blow into one of these Trunks towards the Plexus, the Air passes into all its Ramifications; and, in some Subjects, these two Veins form one Trunk, which opens into the Sinus.

† To be able to examine them as we ought, the loose Portions must be made to swim in clear Water, and be there carefully expanded; then, by the Help of a Microscope, we shall see these Tubercles in the natural State, like small Folliculi, or little Bags, more or less flattened.

Infundibulum; and surrounded by the small circular Sinuses which communicate with the Sinus Cavernosi.

The CEREBELLUM is contained under the transverse Septum of the Dura Mater: It is broader laterally than on the anterior or posterior Sides, flattened on the superior Side, and easily inclined both Ways, answerable to the Septum which serves it as a kind of Tent, or Cieling: On the inferior Side it is rounder, and on the posterior Side it is divided into two Lobes, separated by the occipital Septum of the Dura Mater.

It is composed, like the Cerebrum, of two Substances, but has no Circumvolutions on its Surface; its Sulci are pretty deep, and disposed in such a Manner as to form thin flat Strata more or less horizontal, between which the internal Lamina of the Pia Mater insinuates itself, by a Number of Septa equal to that of the Strata.

Under the transverse Septum it is covered by a vascular Texture which communicates with the Plexus Choroïdes: It has two middle Eminences, called Appendices Vermiformes; one anterior and superior, which is turned anteriorly; the other posterior and inferior, which goes posteriorly: There are likewise two lateral Appendices, both turned externally. They are termed Vermiformes from their Resemblance to a large Portion of an Earth Worm.

Besides the Division of the Cerebellum into lateral Portions, or two Lobes, each of these Lobes seems to be likewise subdivided into three Protuberances; one anterior, one middle or lateral, and one posterior: But they are not in all Subjects equally distinguished, either by their Convexity, or Limits; but they may always be distinguished by the Direction of their Strata, those of the middle
and

and anterior Protuberances being less transverse than in the posterior.

When we separate the two lateral Portions or Lobes, having first made a pretty deep Incision, we first discover all the posterior Portion of the Medulla Oblongata; and in the posterior Surface of this Portion, from the Tubercula Quadrigena, all the way to the posterior Fissure in the Body of the Cerebellum, and a little below that Fissure, we observe an oblong Cavity which terminates anteriorly like the Point of a writing Pen: This Cavity is called the fourth Ventricle.

At the Beginning of this Cavity, immediately behind the small common Canal which lies under the Tubercles, we meet with a thin medullary Lamina, which is looked upon as a Valve between that Canal and the fourth Ventricle; a little behind this Lamina the Cavity grows wider towards both Sides, and then contracts again to its first Size: It is lined interiorly by a thin Membrane, and seems oftentimes to be distinguished into two lateral Parts by a kind of small Sinus, from the valvular Lamina to the Point of the Calamus Scriptorius.

This Membrane is a Continuation of that which lines the small Canal, third Ventricle, Infundibulum, and the two great Ventricles*.

On each Side of this Ventricle the medullary Substance forms a Trunk which expands itself, in Form of Laminæ, through the cortical Strata: These medullary Laminæ are discovered, according to their Breadth, by cutting the Cerebellum in Slices almost parallel to the Basis of the Cere-

* To be able to see the fourth Ventricle in its natural State, in which it is narrowest, it must be laid open whilst the Cerebellum remains in the Cranium; and, in order to that, the Os Occipitis must be sawed very low down.

brum; but if one Lobe of the Cerebellum be cut vertically from above inferiorly; the medullary Substance will appear to be dispersed, in Ramifications, through the cortical Substance. These Ramifications have been named *Arbor Vitæ*, and the two Trunks from whence these different Laminæ arise are called *Pedunculi Cerebelli*.

We cannot pursue the Description of the other middle Parts of the Basis of the Cerebellum before that of the middle Parts of the Basis of the Cerebrum, because these two Kinds of Parts are united, and jointly form the *Medulla Oblongata*. I shall only add here, that the Strata of both Substances of the Cerebellum are not always of the same Extent in the same Portions or Protuberances of each Lobe. This appears by merely viewing the convex or external Surface of the Cerebellum; for there we see, at different Distances, some cortical Strata shorter than others; and likewise, that the Extremities of the short Strata diminish gradually, in Thickness, till they are quite lost between two long ones.

If we make a small Aperture in the external Lamina of the *Pia Mater* over one of the Lobes of the Cerebellum, without touching the internal Lamina, and then blow into the cellular Substance by which these two Laminæ are connected, thro' a small Pipe introduced into the Opening; the Air will gradually swell that Substance, and separate the Strata, more or less equally, from each other, through their whole Extent; and we shall see, at the same Time, the Disposition of all the membranous Septa or Duplicatures of the internal Lamina of the *Pia Mater*, with the numerous Distribution of the fine sanguiferous Vessels which run upon it, especially after a lucky Injection, or in an inflammatory State of these Membranes.

The MEDULLA OBLONGATA is a medullary Substance situated from before posteriorly in the middle Part of the Bases of the Cerebrum and Cerebellum, without any Discontinuation, between the lateral Parts of both these Bases; and therefore it may be looked upon as one middle medullary Basis common to the Cerebrum and Cerebellum by the reciprocal Continuity of their medullary Substances, through the great Fissure in the transverse Septum of the Dura Mater; which common Basis lies immediately on that Portion of the Dura Mater which lines the Basis of the Cranium.

The Medulla Oblongata is therefore justly esteemed to be a third general Part of the whole Mass of the Brain, or as the common Production or united Elongation of the whole medullary Substance of the Cerebrum and Cerebellum*.

The inferior Side of the Medulla Oblongata, in an inverted Situation, presents to our View several Parts which are, in general, either medullary Productions, Trunks of Nerves, or Ramifications of sanguiferous Vessels.

The chief medullary Productions are these: The large or anterior Rami of the Medulla Oblongata, which have likewise been named Crura Anteriora, Femora and Brachia Medullæ Oblongatæ, and Pedunculi Cerebri; the transverse Protuberance, called likewise Processus Annularis, or Pons Varolii; the small or posterior Rami called

* It is extremely difficult, if not altogether impossible, to examine or demonstrate it, as we ought, in its natural Situation: but we are obliged to do both on a Brain inverted: And, in this Instance, the Direction I gave in the Description of the Skeleton, concerning the Method of examining and demonstrating the Basis Cranii, cannot take Place. However, to prevent false Ideas, either in viewing ourselves, or in shewing to others, the Medulla Oblongata, thus inverted, it is very necessary often to call to Mind, that all that appears superior in that Situation, is inferior in the natural State.

Pedunculi Cerebelli, or Crura Posteriora Medullæ Oblongatæ; the Extremity or Cauda of the Medulla Oblongata, with two Pairs of Tubercles, one of which is named Corpora Olivaria, the other Corpora Pyramidalia; and to all these Productions we must add a Production of the Infundibulum and two medullary Papillæ.

The great Rami of the Medulla Oblongata are two very considerable medullary Fasciculi, the anterior Extremities of which are separated, and the posterior united, so that, taken both together, they represent a Roman V. These Fasciculi are flat, much broader anteriorly than posteriorly, their Surfaces being composed of several longitudinal and distinctly prominent medullary Fibres; their anterior Extremities seem to be lost at the inferior Part of the Corpora Striata; and it is for that Reason that they are looked upon as the Pedunculi of the Cerebrum.

The transverse, annular, or rather semi-annular Protuberance, is a medullary Production, which seems, at first Sight, to surround the posterior Extremities of the great Rami; but the medullary Substance of this Protuberance is, in Reality, intimately mixed with that of the two former*.

The small Rami of the Medulla Oblongata are lateral Productions of the transverse Protuberance, which, by their Roots, seem to encompass that medullary Portion in which the fourth Ventricle, or Calamus Scriptorius, is formed. They form in the Lobes of the Cerebellum, on each Side, these medullary Expansions, a vertical

* VAROLIUS, an antient Italian Author, viewing those Parts in an inverted Situation, compared the two Rami to two Rivers, and the Protuberance to a Bridge over them both; and from thence it has the Name of PONS VAROLII. Its Surface is transversely streaked, and it is divided into two lateral Parts by a very narrow longitudinal Depression, which does not penetrate its Substance.

Section of which shews the white Ramifications commonly called *Arbor Vitæ*; and they may be justly enough called *Pedunculi Cerebelli*.

The Extremity is no more than the Medulla Oblongata contracted in its Passage posteriorly to the anterior Margin of the great Foramen of the *Os Occipitis*, where it terminates in the Medulla Spinalis; and in this Part of it several Things are to be taken Notice of. We first see four Eminences, two named *Corpora Olivaria*, and the other two *Corpora Pyramidalia*; immediately afterwards it is divided into two lateral Portions by two narrow Sinuses, one on the superior Side, the other on the inferior: They both penetrate the Substance of the Medulla, as between two Cylinders, flatted on that Side by which they are connected*.

The *Corpora Olivaria* and *Pyramidalia* are whitish Eminences situated longitudinally near each other on the inferior Side of the Extremity or Cauda, immediately behind the transverse or annular Protuberances; the *Corpora Olivaria* are in the Middle, so that the Interstice between them, which is only a kind of superficial Sinus, answers to the inferior Sinus of the following Portion.

The *Corpora Pyramidalia* are two lateral Eminences depending on the *Olivaria*. WILLIS gave the Name of *Pyramidalia* to what WINSLOW calls *Olivaria*, as does DU VERNEY; These four Eminences are situated on the inferior Half of the Medulla; which Observation we here repeat, that it may be the better remembered that, in all the Fi-

* When we separate these Ridges with the Fingers, we observe a crucial Intertexture of several small medullary Filaments which go obliquely from the Substance of one lateral Portion into the Substance of the other. Dr. PETIT, Member of the Royal Academy of Sciences, is the first who has observed this; by which we are enabled to explain several Phenomena in Physiology and Pathology.

gures and Demonstrations, these Parts are represented as superior, which, in their natural Situation, are inferior. Thus these Eminences are under the fourth Ventricle and the Pedunculi Cerebelli.

The Tubercula Mammillaria, which are situated very near the Production of the Infundibulum, have been taken for Glands, probably because of their greyish internal Substance; which, however, does not seem to be any ways different from that of several other Eminences of the Medulla Oblongata: And, for that Reason, we choose rather to call them, from their Figure, Tubercula Mammillaria, than Papillæ Medullares.

These Tubercles seem to have some immediate Relation to the Radices or Bases of the anterior Column of the Fornix; so that they might be named, as SANTORINI has done, the Bulbs of these Radices; though they likewise appear to be partly a Continuation of other Portions of the cortical and medullary Substance, of a particular Texture.

The Beak or Tube of the Infundibulum is a very thin Production from the Sides of that Cavity; and it is strengthened by a particular Tunic given to it by the Pia Mater: It is bent a little from behind anteriorly towards the Glandula Pinealis, and afterwards expands again round this Gland.

The Membrana Arachnoïdes, or external Lamina of the Pia Mater, appears to be very distinctly separated from the internal Lamina in the Interstices between all these Eminences on the inferior Side of the Medulla Oblongata, without any visible cellular Substance between them: The internal Lamina adheres much more to the Surface of these Interstices than to those of the Eminences.

nences. The external Lamina is, as it were, suspended by the Eminences, and equally extended between their most prominent Parts, to which it adheres very close; and, in this Respect, the Radices or great Cornua of the Optic Nerves may be joined to them.

We must observe in general, concerning the Eminences of the Medulla Oblongata, that those which are medullary externally, are internally either entirely cortical, or partly so and partly medullary, or formed by a singular Mixture of these two Substances, which still remains to be unfolded, as well as many other Particularities observable in examining the internal Structure of the Brain.

From this common Portion of the Cerebrum and Cerebellum arise most of the Nerves which egress from the Cranium through the different Foramina; and the rest are produced from the Medulla Spinalis, which is no more than a common Elongation of the Cerebrum and Cerebellum, and of their different Substances: And therefore the Medulla Oblongata may be said to be the first Origin or primitive Source of all the Nerves.

Each lateral Portion sends off from the anterior and posterior Sides, between the Sinuses and the Margins, at different Distances, flat Fasciculi of nervous Filaments turned towards the nearest Margin: The anterior and posterior Fasciculi, having got a little beyond the Margin of the Medulla, unite in Pairs, and form on each Side a kind of Nodes, by Anatomists called Ganglions, each of which produces a nervous Trunk: These Ganglions are composed of a Mixture of cortical and medullary Substance, accompanied by a great Number of small sanguineous Vessels.

The DURA MATER, which invests the Medulla, sends out, on each Side, the same Number of Vaginæ as there are Ganglions and nervous Trunks:

These Vaginæ are Productions of the external Lamina, the internal Lamina of which is very smooth internally, and perforated by two Foraminula very near each other where each Vagina egresses, thro' which Apertures the Extremities of each anterior and posterior Fasciculus are transmitted; and, immediately after their Passage through the internal Lamina, they unite.

The triangular Spaces left between the anterior and posterior Fasciculi and Margin of the Medulla are filled, from one Extremity to the other, by an indented Ligament, very thin and shining, having the same Number of Indentations as there are Pairs of Fasciculi: It is fixed, at different Distances, to the Margin of the Medulla, from whence it sends Filaments to the internal Lamina of the Dura Mater, by which the anterior Fasciculi are distinguished from the posterior.

The Membrana Arachnoïdes is here very distinct from the internal Lamina of the Pia Mater; so that, by blowing through a Hole made in the Arachnoïdes, it will swell, from one End to the other, like a transparent Intestine: The internal Lamina, called in this Place simply the Pia Mater, adheres very closely to the Medulla Spinalis, and sends many Productions and Septa through its Substance*.

The Membrana Arachnoïdes adheres more closely to the Pia Mater at the inferior than at the superior Part, being, in a Manner, suspended by the indented Ligament which runs along both Margins of the Medulla, and is fixed, by a Filament, to the internal Lamina of the Dura Mater.

* When we blow through an Aperture, made in the Pia Mater, through the Substance of one lateral Portion of the Medulla, the Air penetrates through the Whole; and the Pia Mater, which covers the other lateral Portion, is separated from it.

in each Interstice between the nervous Fasciculi: It also gives off Elongations, in the same Manner as the Dura Mater, to each nervous Trunk.

The MEDULLA SPINALIS is only an Elongation of the Extremity of the Medulla Oblongata; and it has its Name from its being contained in the osseous Canal of the Spina Dorsi: It is, consequently, a Continuation or common Appendix of the Cerebrum and Cerebellum, as well because of the two Substances of which it is composed, as because of the Membranes by which it is invested.

The DURA MATER, after it has lined the whole internal Surface of the Cranium, egresses by the great occipital Foramen, and forms a kind of Tube in its inferior Progress through the osseous Canal of the Vertebrae: As it goes out from the occipital Aperture, it joins the Beginning of the ligamentary Tube already mentioned, and adheres very strongly to it. That Portion of the Pericranium which terminates exteriorly at the Margin of the great Foramen, joins the Tube also; which, by all these Accessions, becomes very strong, and capable of resisting the greatest Violences.

This Adhesion of the Dura Mater to the ligamentary Tube is gradually discontinued below the first Vertebra, and thence the Dura Mater forms a separate Tube, which descends in the vertebral Canal all the way to the Os Sacrum, the Capacity answering to it; but it does not adhere closely to the Sides, as it does to those of the Cranium. It is surrounded by a slimy Substance, which, near the inferior Extremity of the Canal, somewhat resembles Fat.

The spinal Marrow is composed of a cortical and medullary Substance as the Cerebrum and Cerebellum, but with this Difference, that the Ash-

coloured Substance lies within the other; and, in a transverse Section of this Medulla, the internal Substance appears to be of the Figure of a Horseshoe, or of the *Os Hyoides*; the convex Side being turned anteriorly, and the Extremities, or *Cauda*, posteriorly.

The Body of the *Medulla Spinalis* descends all the way to the first lumbar Vertebra, where it terminates in a Point. The Size of it is proportionable to that of the osseous Canal, so that it is larger in the cervical than in the dorsal Vertebrae. It is a little flattened anteriorly and posteriorly; so that we may distinguish in it two Sides, and two Margins. It is likewise, in a Manner, divided into two Semi-laterals by a Sinus, which runs along the Middle of each Side, being a Continuation of those in the Extremity of the *Medulla Oblongata*.

In the posterior Part of the *Medulla Spinalis*, near its inferior Extremity, there is, in some Subjects, a longitudinal Depression, in which several transverse Fibres are situated, which, tho' I have not examined any farther, I thought proper to mention here. WINSLOW.





LECTURE VIII.

Of the Sanguiferous Vessels of the BRAIN and MEDULLA SPINALIS, with the Uses.

THE Arteries which supply the Cerebrum, Cerebellum, and Medulla Oblongata, come partly from the Carotids which enter the Cranium thro' the Canals in the Apophyses Petrosæ of the Ossa Temporum, and partly from the Vertebrales which enter by the great occipital Foramen, and send off the Arteriæ Spinales into the Canal of the Spine for the Medulla lodged there.

All these Arteries are divided into several Branches which send out a great Number of Ramifications distributed through both Substances of the Brain, and through the whole Extent of the Pia Mater; the Dura Mater, both of the Cerebrum and Cerebellum, has Arteries peculiar to it.

The internal Carotid, on each Side, enters the Cranium by the great Canalis Petrosus, in an angular or winding Course; the internal Surface of this Canal is lined by a Production common to the Dura Mater and inferior Pericranium, to which the Artery adheres only by a loose filamentary Substance, in which the plexiform Filaments run that belong to the great sympathetic Nerve, commonly called the Intercostal.

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Having passed through the osseous Canal, it immediately ascends towards a Scissure in the sphenoid Bone, and through that Scissure it enters the Cranium; immediately after this it penetrates the cavernous Sinus on the Side of the Sella Sphenoidalis, where, having formed a third Curvature. it egresses from it from below upwards, and is bent a fourth Time round the anterior clinoid Apophysis, from before backwards: By this Course it is, in a Manner, bathed in the Blood of the cavernous Sinus, together with the third, fourth, fifth, and sixth Pair of Nerves.

After this fourth Curvature the internal Carotid, having now reached the Side of the Infundibulum, and, consequently, being very near its Fellow, these two Arteries communicate sometimes by a very short transverse arterial Production: At this Place each of them divides into two principal Rami, one anterior, the other posterior; and sometimes into three; in which Case there is a middle Branch between the two former.

The anterior Branch first runs anteriorly under the Basis of the Cerebrum, separating a little from the same Branch of the other Carotid; they approach each other again under the Interstice between the two olfactory Nerves, communicating by a very short Anastomosis, and sending small Twigs to that Pair of Nerves: They afterwards separate, each being divided into two or three Rami.

The first Ramus of the anterior Branch goes to the anterior Lobe of the Cerebrum; the second, which is sometimes double, is inverted on the Corpus Callosum, to which it gives Ramifications, as also to the Falx of the Dura Mater and middle Lobe of the Cerebrum; the third, which is sometimes a distinct Branch, sometimes only an additional Ramus to the second, goes to the posterior Lobe of the Cerebrum; this third
Ramus

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Ramus is sometimes so considerable, as to deserve to be reckoned the middle Branch of the three principal ones.

The posterior Branch first communicates with the vertebral Artery of the same Side, and then is divided into several Rami on the superficial Circumvolutions of the Cerebrum, and between these Circumvolutions all the way to their Basis; the anterior and middle Rami, when there are three, distribute the same kind of Ramifications to the Circumvolutions and their Interstices.

All these Ramifications run in the Duplicature of the Pia Mater, from which they receive a kind of additional Tunics; and the Capillaries, being distributed upon it in a reticular Manner, do afterwards penetrate the cortical and medullary Substance, in which last they terminate insensibly.

The vertebral Arteries enter thro' the great occipital Foramen, having first pierced, on each Side, the Elongations of the Dura Mater at the same Place where the sub-occipital Nerves, or those of the tenth Pair, penetrate it, as they egress; the Arteries, in this Place, lying above the Nerves.

At their Entry into the Cranium they each send several Ramifications to the Cauda of the Medulla Oblongata, and to the Corpora Olivaria and Pyramidalia, which Ramifications are distributed on the Sides of the fourth Ventricle, produce the Plexus Choroïdes, are spread on the whole Surface of the Cerebellum, insinuate themselves between the Strata, always invested by the Duplicature of the Pia Mater, and are, at length, lost in both Substances of the Cerebellum.

Afterwards the two vertebral Arteries turn towards each other, for the most part, immediately under the posterior Margin of the great transverse or semi-annular Protuberance of the Medulla Oblongata, where they unite, and form one common

Trunk; this Trunk passes directly from behind forwards, under the Middle of the great Protuberance, and partly in the middle Sinus or convex Surface of that Protuberance, at the anterior Margin of which it terminates.

In its Passage through the Sinus, this Trunk sends off several small Rami, on each Side, which surround transversely the lateral Portions of the Protuberance, being partly lodged in the small lateral Sinuses of these Portions; these lateral Rami are afterwards distributed to the circumjacent Parts of the Cerebrum, Cerebellum, and Medulla Oblongata.

This common or middle Trunk of the vertebral Arteries, having reached the Margin of the great Protuberance, is again divided into two small Rami; each of which soon communicates with the Trunk of the internal Carotid on the same Side: Instead of this Bifurcation, the two last or most anterior lateral Rami each send sometimes a small Ramus anteriorly, which forms the Anastomosis with the internal Carotids.

The principal Arteries of the Medulla Spinalis, commonly called *Arteriæ Spinalis*, are two in Number, one anterior, and one posterior, lodged in the Sinuses by which the Medulla is divided into lateral Portions on both Sides: They arise from the vertebral Arteries a little above the great occipital Foramen, where these Arteries send each a small Ramus downwards as soon as they enter the Cranium; and, having got under the Extremity of the Medulla Oblongata, they send off two other Rami posteriorly.

The two first Rami, uniting soon after their Origin, form the *Arteria Spinalis Anterior*, which runs down, within the Canal of the *Vertebræ*, along the anterior Sinus of the Medulla; the other two small Rami are inverted on the Sides of the

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Medulla Oblongata, and thence running posteriorly, they unite much in the same Manner with the first two, and form the Arteria Spinalis Posterior, which descends along the posterior Sinus of the Medulla Spinalis.

The two spinal Arteries, in their Course, descending along the Medulla, send off, on each Side, lateral Ramifications, by which they frequently communicate with each other, and likewise with the vertebral Arteries of the Cervix, the Intercostrals, and sometimes they are, in a Manner, split, for a little way, and then unite again.

The Veins of the Cerebrum, Cerebellum, &c. may, in general, be looked upon as Rami not only of the longitudinal Sinus of the Dura Mater, and of the two great lateral Sinuses, but also of all the inferior Sinuses of that Membrane; in all which Sinuses the Veins terminate by different Trunks. Their principal Ramifications accompany all the cortical Circumvolutions of the Cerebrum, and Directions of the Strata of the Cerebellum, running always in the Duplication of the Pia Mater. The Veins of the Plexus Choroïdes, in general, are of the Number of these already mentioned.

The Veins of the Medulla Spinalis are Rami partly of the superior Extremities of the two vertebral Veins, partly of the two venal Ligaments termed Sinus Venosi, which descend both ways laterally on the anterior convex Side of the Production of the Dura Mater, and form, at different Distances, reciprocal Communications, by semi-annular Curvatures, as so many subordinate Sinuses: The two longitudinal Sinuses communicate likewise, in their Passage, with the vertebral Veins, in the same Manner as the circumjacent Arteries.

USES OF THE BRAIN, AND ITS APPENDAGES IN GENERAL.

We are obliged to the great MALPIGHI for the first and best Instructions concerning the Manner of examining the Structure of the Brain, especially that of the two Substances of which it is composed, and enables us to conjecture somewhat about its Uses. The Experiments and Observations of that illustrious and faithful Searcher into Nature, having been repeated by several excellent Philosophers, and confirmed by comparative Anatomy, leave us no Room to doubt but that the Brain is a secretory Organ, or, as it is called by Anatomists, a Gland.

It is to no Purpose to dispute about Words, when we are agreed as to the Things themselves: Anatomists have, for many Years past, understood by the Word Gland, an Organ fitted to separate some particular Fluid from the Mass of Blood; as universally as they mean by the Word Muscle, all Sorts of fleshy Fibres capable of Contraction: And this last Term might be cavilled at, and rejected, as justly as the other.

The whole Matter of Secretions must be owned to be very obscure; but it is to be hoped, that the Brain and Liver will, some Time or other, lead us so far from the Knowledge of it, as, at least, to be able to distinguish Truth from Falshood.

The greyish or ash Colour of the cortical Substance is not the Effect of a particular Mixture of red and white, at least we have no Experiment to prove it: The Blood, indeed, gives this Substance a slight reddish Cast; but the ash Colour, which seems to be the Characteristic of the Structure of these secretory Organs, is not owing to that.

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We learn, from RUYSCH's anatomical Injections, that the cortical Substance is chiefly composed of Vessels; that, by making these Vessels swim in a pellucid Liquor, their Extremities represent an infinite Number of fine Brushes, or vascular Tufts; and that his Injection fills even the smallest Filaments of the Tufts. He tells us likewise, that, in these last Filaments, the Structure is altered; and that, by the Mechanism of this Change, the Functions attributed to Glands may be performed.

But still these Injections and Preparations do not unravel the Mystery; nor is the Existence of these Pencils, or Tufts, sufficiently demonstrated: For they are only the last Extremities of the small Arteries macerated in Water, or some other Liquor, after being injected, and then artfully separated from the other essential Parts of the Organ.

In the first Place, they are separated from the venal Extremities which must answer to these Tufts, in what Manner soever that be brought about. 2. They are separated from the membranous Filaments of the Pia Mater, which, in the natural State, tie these arterial Extremities to each other, and give them a different Disposition from that of Tufts, or Pencils. 3. By this Preparation the arterial Extremities are separated from their Connexions with the medullary Substance; which both Experiments, and comparative Anatomy shew to be fibrous.

It is no ways surprizing that these capillary Extremities, thus stripped, should float loosely and freely, when moved in a Fluid; and that they should put on the Appearance of Pencils or Tufts; being, in this State, only the truncated Extremities of small Vessels. When we consider these Circumstances attentively, we find ourselves obliged to return to the small glandular Bodies and Folliculi, &c. of MALPIGHI; and, at the same Time,

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Time, we must acknowledge, that RUYSCH's fine Injections have discovered these minute Bodies to be of a vascular Substance, the Structure of which we are still ignorant of.

In short, MALPIGHI has discovered the glandular Tubercles and Folliculi, without destroying their natural Connexions; RUYSCH has discovered a considerable Part of their Structure, by destroying their Connexions: We are therefore very much beholden to both these illustrious Anatomists; and it is only by joining their Observations that we can ever be able to form an Idea of the secretory Organs which will answer all the Phænomena concerning the different Secretions in the human Body.

The infinite Number of these small secretory Clusters filtre the Mass of Blood carried to them by the numerous Ramifications already mentioned, and separate from it an extremely fine Fluid; the remaining Blood being conveyed back, by the same Number of venal Extremities, into the Sinuses of the Dura Mater, and from thence into the jugular and vertebral Veins.

This subtil Fluid, commonly called animal Spirit, nervous Juice, or Liquor of the Nerves, is continually forced into the medullary Fibres of the white Portion of the Cerebrum, Cerebellum, Medulla Oblongata, and Medulla Spinalis; and, by the Intervention of these Fibres, supplies and fills the Nerves, which are a Continuation of them.

All the nervous Ligaments, as they pass thro' the Foramina of the Cranium and Vertebrae, are accompanied by particular Elongations of the Pia and Dura Mater: Those of the Dura Mater serve them for Vaginae in their Passage through the osseous Openings; those of the Pia Mater not only accompany and invest each nervous Ligament, but also form internal Septa between all the Filaments of which each Ligament consists.

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It is known, from many Experiments, that the Nerves are the primitive or original Organs of all muscular Motion and animal Sensation; and that these two Functions depend, in general, on the Brain: But we are ignorant of the Nature of this Dependance, and of the particular Uses of the medullary Fibres, of the nervous Fluid, and of the membranous Productions which accompany the Fibres and Nerves.

Nor is there any Thing certain in what has been said concerning the Design or particular Uses of the superficial Conformation of the Cerebrum and Cerebellum, or of the different Configuration of their Turnings, Circumvolutions, Eminences, Depressions, Expansions, and various Plicæ.

It may be affirmed, in general, that, by this Structure, the Extent of the secretory Organ of the nervous Fluid is increased very considerably, and the particular Functions of each nervous Ligament distinguished, and likewise their general and reciprocal Correspondence, both in regard to the Exquisiteness of the Organs of Sensation, and the Activity of the Organs of Motion.

The Falx of the Dura Mater hinders one Portion of the Cerebrum from pressing on the other, when we lie on one Side; the transverse Septum serves for a Tent to the Cerebellum, and defends it from a mortal Compression, which it must otherwise be liable to from the Cerebrum, especially when we walk, or jump.

The Septum and Productions of the Pia Mater connect and strengthen all the Circumvolutions, Divisions, and Ridges, of the Cerebrum, Cerebellum, &c. and sustain, in a general and almost incomprehensible Manner, all the Branches and Ramifications of the sanguiferous Vessels, all the medullary Filaments, and all the Elongations and Ligaments which depend on these.

A DISSERTATION on the BRAIN. By STENO.

GENTLEMEN,

INSTEAD of promising that I shall satisfy your Curiosity in what relates to the Anatomy of the BRAIN, I begin by publickly and frankly owning, that I know nothing of the Matter. I wish I was the only Person under a Necessity of talking in this Manner; because I might, in Time, become acquainted with what others know: And it would be a great Blessing to Mankind if this most delicate Part, and which is liable to so many dangerous Diseases, were as well understood as the Generality of Anatomists and Philosophers imagine it to be. In this, few imitate the Sincerity of SILVIUS, who never talks positively concerning the Brain, though he has been at more Pains about it than any Man that I know. The Number of those, who think every Thing easy, is infinitely the greatest; and they give us the History of the Brain, and Disposition of its Parts, with the same Confidence and Assurance as if they had been present at the Formation of this surprising Machine, and had been let into all the Designs of the Great Architect.

Though the Number of these positive Gentlemen be very great, and though I cannot pretend to answer for the Sentiments of all the rest; I am, nevertheless, very much convinced that they who search for solid Knowledge, will find nothing satisfactory in all that has been written about the Brain.

It is very certain, that it is the principal Organ of the Soul, and the Instrument by which it works
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very wonderful Effects. The Soul, which imagines it can penetrate into every Thing without it, and that nothing in the World can set Bounds to its Knowledge; is, nevertheless, utterly at a Loss to describe its own Habitation; and is no-where more to seek than at Home. We need only view a Dissection of that large Mass, the Brain, to have Ground to bewail our Ignorance. On the very Surface you see Varieties which deserve your Admiration; but when you would look into its internal Substance, you are utterly in the Dark, being able to say nothing more than that there are two Substances, one greyish, the other white; which last is continuous with the Nerves distributed all over the Body: That the greyish Substance serves, in some Places, for a Cortex to the white; and that, in other Places, it separates the white Filaments from each other.

If we are asked what these Substances are, in what Manner the Nerves are joined in the white Substance, or how far their Extremities penetrate it? All we can do is, to own our Ignorance, except we are resolved to increase the Number of those who prefer the Applause of the Public to Sincerity and Truth. For, to say that the white Substance is only a uniform Body like Wax, without any Art concealed in it; would be to think too meanly of this great Master-piece of Nature.

We are sure, that wherever there are Fibres in the Body, they always observe a certain regular Order, more or less complex, in Proportion to the Functions for which they are appointed. If this Substance is every-where fibrous, as it appears in many Places to be, you must own, that these Fibres are disposed in the most artful Manner; since all the Diversity of our Sensations and Motions depends upon them. We admire the Contrivance
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of the Fibres of every Muscle, and ought still more to admire their Disposition in the Brain, where an infinite Number of them, contained in a very small Space, do each execute their particular Offices without Confusion or Disorder.

The Ventricles or Cavities of the Brain are no less unknown than its Substance: Those who place the animal Spirits there, think they are as much in the right as those who make them the Receptacles of the Excrements; but they are both equally puzzled, when they are desired to explain the Origin of these Spirits and Excrements. These may come from the Vessels found in these Cavities, as well as from the Substance of the Brain; and it is equally difficult to determine how they get out.

Among those who place the animal Spirits in the Ventricles, some make them pass from the anterior to the posterior Ventricles, there to meet with the Entries of the Nerves; while others affirm, that these Entries are in the anterior Ventricles. Some imagine, that the Excrements of the Brain are contained in the Ventricles, because they think they see somewhat like Excrements there; but they own, that there is as ready a Passage for them from the Brain down to the Medulla, as into the Infundibulum: And, supposing they go into the Infundibulum, they may be carried from thence into the Sinuses of the Dura Mater; and there is some Reason to believe that they may have an immediate Passage into the Eyes, Nares, and Mouth.

We are still more uncertain about what relates to the animal Spirits. Are they Blood, or a particular Substance separated from the Chyle by the Glands of the Mesentery? Or may they not be derived from a lymphatic Serum? Some compare them to Spirit of Wine; and it may be doubted whether

whether they are not the Matter of Light. Our common Dissections cannot clear up any of these Difficulties.

The true Manner of dissecting the Brain is as little known as its Substance. I need not mention the Method of cutting it into Slices, because it is owned, by every-body, that nothing can be learned that way. The second Method of unfolding all the Plicæ is somewhat more artful; but it only shews us the external Surface of what we want to know, and even that very imperfectly.

The third Method of unfolding the Plicæ, and separating the two Substances, goes no farther than the Surface of the Medulla. These three Methods have been differently combined; and they may be still more diversified, according as they are executed longitudinally, transversely, &c.

As for my own Part, it is my Opinion, that the true Method of Dissection would be to trace the nervous Filaments through the Substance of the Brain; to see which Way they pass, and where they end; but this Method is accompanied with so many Difficulties, that I know not whether we may hope ever to see it executed without a particular Manner of preparing. The Substance of the Brain is so soft, and the Fibres so tender, that they can hardly be touched without breaking.

Since, therefore, Anatomy has not hitherto arrived to that Degree of Perfection as to make the true Dissection of the Brain; let us, without flattering ourselves any longer, freely acknowledge our Ignorance, that we may not first deceive ourselves, and others afterwards, by promising to shew them the true Structure of this Organ.

I should tire your Patience, instead of entertaining you, were I to mention particularly all the Disputes that have arisen about the Brain: Books are but too full of them; and therefore I shall

only relate the principal Mistakes that still subsist among Anatomists, and which may be corrected by Anatomy: And they may be reduced to these Heads.

Some pretend to shew Parts in the Brain as separate, which are only a Continuation of the same Substance; and others would persuade us, that these Parts touch each other without any Connexion, though they are visibly joined together by Filaments or Vessels. Some situate the Parts in a Manner which is most agreeable to the Systems they have framed, without considering that they are quite otherwise situated by Nature.

They shew you the Pia Mater, for instance, in Places where it never was; and do not see the Dura Mater in Places where it is very visible: And, in case of Need, they will make the very Substance of the Brain pass for a Membrane.

I have too good an Opinion of Men of Learning in general, to believe that they do this with a Design to deceive others; but the Principles which they have established, and the Method of Dissection to which they have accustomed themselves, oblige them to it. All Anatomists would demonstrate the Parts the same Way, if they made Use of the same Method; and therefore we ought not to be surpris'd, if their Systems are very ill founded.

The Antients were so far prepossessed about the Ventricles, as to take the anterior for the Seat of common Sense, the posterior for the Seat of Memory, that the Judgment, which (they said) was lodged in the Middle, might more easily reflect on the Ideas which came from either Ventricles. I would only ask those, who are still of the same Opinion, to give us the Reason why we should believe them; for there is nothing satisfactory in all that has been hitherto said in Favour of it: And

as that fine arched Cavity of the third Ventricle, where they placed the Throne of Judgment, does not so much as exist; we may easily see what Judgment is to be pronounced on the rest of this System.

WILLIS is the Author of a very singular Hypothesis. He lodges common Sense in the Corpora Striata, the Imagination in the Corpus Callosum, and Memory in the cortical Substance. But, without being at Pains to enter into a Detail of his whole Hypothesis, we need only make the following Remarks upon it: He describes the Corpus Striatum as having two Sorts of Striæ, one ascending, the other descending; and yet, if you separate the cortical from the white Substance, you will perceive, that these Striæ are all of the same Nature; that is, that they are Part of the Substance of the Corpus Callosum which runs towards the Medulla Spinalis, parted into different Lamellæ by the Intervention of the Ash-coloured Substance.

How can he then be sure that these three Operations are performed in the three Bodies which he pitches upon? Who is able to tell us whether the nervous Fibres begin in the Corpora Striata, or if they pass through the Corpus Callosum all the way to the cortical Substance? We know so little of the Structure of the Corpus Callosum, that a Man, of a tolerable Genius, may say whatever he pleases about it.

DESCARTES too well knew how imperfect a History we have of the human Body, to attempt an Exposition of its true Structure; and, accordingly, in his *Tractatus de Homine*, his Design is only to explain a Machine capable of performing all the Functions done by Man. Some of his Friends, indeed, have expressed themselves, on this Subject, differently from him; but it is evident,

from the Beginning of that Work, that he intended no more than what I have said: And, in this Sense, it may be justly said, that DESCARTES has gone beyond all other Philosophers. He is the only Person who has explained mechanically all the human Actions, and especially those of the Brain; other Philosophers describe the human Body itself. DESCARTES speaks only of a Machine; but in such a Manner, as to convince us of the Insufficiency of all that had been said before him, and to teach us a Method of enquiring into the Uses of the Parts with the same Evidence that he demonstrates the Parts of his Machine called Man, which none had done before him.

We must not therefore condemn DESCARTES, though his System of the Brain should not be found altogether agreeable to Experience. His excellent Genius, which shines no-where more than in his *Tractatus de Homine*, casts a Veil over the Mistakes of his Hypotheses; especially since even VESALIUS himself, and other Anatomists of the first Rank, are not altogether free from such Mistakes: And since we can forgive these great Men their Errors, who passed the greatest Part of their Lives in dissecting; why should not DESCARTES have the same Indulgence, who has happily employed his Time in other Speculations?

The Respect which I, and all the World, owe to such superior Geniuses, would have inclined me to continue only to admire this Treatise as containing the Description of a fine Machine invented by the Author, if I had not met with several Persons who would make us believe that it is a faithful Relation of the most secret Springs of the real human Body.

Since these Persons are not convinced, by SILVIUS's repeated Demonstrations, that DESCARTES's Descriptions do not agree with what appears in dis-

dissecting the human Body; I find myself obliged to point out some Parts of his System, without relating the Whole: In which they must see, if they have a Mind to be instructed, the vast Difference there is between DESCARTES's imaginary Machine and the real Machine of the human Body.

The Glandula Pinealis has been the Subject of the greatest Disputes concerning the Anatomy of the Brain: But before I enter upon that Matter, or endeavour to determine the Place where it lies, I must first relate DESCARTES's Opinion in his own Words, contained in the following Passages; to which I have added several others, taken from the same Treatise, at the End of this Discourse.

“ The Surface of the Glandula Pinealis has a
“ Relation to the inner Surface of the Brain.

“ In the Concavity of the Brain the Pores are
“ directly opposite to those of the small Gland.

“ The Spirits run, from all Sides of the Gland,
“ into the Concavities of the Brain.

“ The Gland may perform its Functions, tho'
“ it be inclined sometimes to one Side, sometimes
“ to the other.

“ The small Tubes on the Surface of the Con-
“ cavities are always turned to the Gland, and
“ may easily be turned towards the different Points
“ of this Gland.”

From all these Passages it is certain, that he believed the Glandula Pinealis to lie entirely in the Cavities of the Brain. And though, in some other Places, he says, that it is situated at the Entry of these Cavities; yet we are not to think that this is contrary to what he advances in the Passages here quoted: For as it is but a very small Body, it may lie either at the Entry, or in any other Place of the Cavities, and yet still be within

them; which he declares to be his Opinion in many other Places.

We are now to examine, whether this Opinion be not contrary to Experience. It is very certain, that the Basis of this Gland reaches immediately from the Passage of the third Ventricle to the fourth; but the posterior Part, that is, one Half of the Gland, may evidently be perceived to be altogether without Cavities, by only removing the Cerebellum, and one or both of the Tubercles of the third Pair, with Dexterity and Care; upon which, the posterior Part of the Gland will be brought to view, and yet no Passage appear, by which the Air, or any other Fluid, can pass into the Ventricles.

To prove that the anterior Part of the Gland is not in the lateral Cavities, we need only look upon them after they have been opened either in SILVIUS's Way, or that of the Antients: For the Substance of the Brain will always be found to lie between these lateral Cavities and the Gland. The same Thing may be demonstrated, without cutting the Substance of the Brain, by separating from its Basis the Part which contains these Cavities; for the Gland will then appear to be so far out of the Cavities, that it can have no manner of Relation to them, being hindered by the Insertions by which this Part is fixed to the Basis.

The Antients very well knew that the Fornix is not continuous with the Basis of the Brain, but that it forms a third Cavity on its inferior Side; and, by forcing Air through the Fissure between the Tubercles of the second Pair, we raise the Fornix; and thus, by breaking the Filaments which connect it to the Basis, a large Cavity is formed: Whence some have imagined, that, when the Spirits swell the Cavities, the Fornix ascends,
and

and all Sides of the Surface of the Gland are turned towards the Cavities.

I say some have imagined this ; because, though the Fornix be raised, in the Manner already said, only the anterior Surface of the Gland can be turned towards the lateral Cavities : But no Preparation, whatsoever, can turn the posterior Surface towards the posterior Ventricles. But if the Brain has suffered no Violence, either in opening the Cranium, forcing in Air, or by any other Method ; the Cavity of this third Ventricle will be found very narrow in the Middle, and to contain nothing but the great Vein which forms the fourth Sinus, and the glandular Bodies, which accompany this Vein.

I own, that, behind this Fissure, and immediately below its posterior Opening, there is a Cavity, lined on the anterior and lateral Parts by that Part of the Plexus Choroïdes which ascends towards the fourth Sinus, and at the posterior Part closed by the Glandula Pinealis, the anterior Portion of which is perfectly continuous ; and, when the Fornix is removed, this Cavity remains entire under the first, in the Shape of a kind of inverted Horn.

What DESCARTES says, that the Glandula Pinealis may perform its Functions, though it inclines sometimes to one Side, sometimes to another, Experience shews to be groundless ; because it is so hemmed in between all the Parts of the Brain, and so fixed to them on all Sides, that it cannot be moved, in the least, without Violence, and without breaking the Fibres by which it is connected. It is easy to shew, likewise, that DESCARTES has not represented it in its true Situation, which is neither perpendicular, as he represents it ; nor inclined forwards, as other very great Anatomists believe ; but its Apex is always turned

towards the Cerebellum, and makes nearly Half a right Angle with the Basis.

The supposed Connexion of this Gland with the Brain, by means of Arteries, is likewise groundless; for the whole Basis of the Gland adheres to the Brain; or, rather, the Substance of the Gland is continuous with that of the Brain, though the contrary be affirmed by DESCARTES.

The Hypothesis of Arteries meeting round the Gland, and thence ascending to the great Euripus, as it is called, is of great Moment in DESCARTES's System, because the Separation and Motion of the Spirits depend upon it: But, if we can believe our Eyes, this is no more than a Collection of Veins from the Corpus Callosum, the interior Substance of the Brain, the Plexus Choroïdes, from different Places of the Basis of the Brain, and from the Gland itself; the Office of which Veins is, to carry back the Blood from the Brain to the Heart, and not to bring it from the Heart to the Brain. Some have thought that DESCARTES designed to carry the Nerves to the Gland; but he never had any such Intention.

Such of DESCARTES's Followers who look upon his Man only as a Machine, will be so good as to believe, that I do not here speak against his Machine, the Contrivance of which I have always admired: But as for those who pretend to demonstrate that DESCARTES's Man is made like other Men; anatomical Observations may easily convince them that this is a fruitless Attempt: And if they should plead the same Experience on their Side; we may readily answer, that there is nothing more common, than not to perceive the Mistakes we commit in dissecting the Brain; as will evidently appear, in the Sequel of this Dissertation.

I designed to have mentioned the other Systems of the Brain by which the animal Actions have been accounted for, and the Origin and Composition of the Fluids, contained in the Brain, been explained; but I considered afterwards, that this Undertaking requires more Application and Leisure than my Time will allow me.

Dissections, or Preparations, being liable to so many Mistakes, and Anatomists having hitherto too readily formed Systems, and moulded these soft Parts in the Manner which was most agreeable to each; we cannot be surprised to find so little Exactness in their Figures. But this Want of Accuracy in the Figures is not owing to bad Dissections only: The Ignorance of Drawers has contributed very much, and the Difficulty of expressing the several Eminences and Depressions of the Parts, and of understanding what Anatomists chiefly insist on, furnishes them with a never-failing Excuse.

From all this we see how the Brain has been hitherto dissected, how little Knowledge has been gained from these Methods of Dissection, and how falsely the Figures represent the Parts which they are designed for. It is easy to conclude, from hence, how little Regard is to be paid to the Systems built on these bad Foundations, in framing of which the Authors, by an unaccountable Sort of Misfortune common to this with all other Arts, have employed obscure Terms, Metaphors, and Comparisons, all of them so ill chosen, as to be equally puzzling to those who have made some Progress in this Science, and those who begin to learn it. Besides, the greatest Number of these Terms are so low and unworthy of the most noble Part of the Body of Man, that I am at a Loss whether I ought most to wonder at the bad Turn of Thought of those who first made Use of them,

or at the Indolence of their Successors, who continue still to retain them.

What Necessity could there be to employ the Words Nates, Testes, Anus, Vulva, and Penis, which, in their common Signification, have no Relation at all to the Parts expressed by them in the Anatomy of the Brain? And, accordingly, what one Author calls Nates, another calls Testes, &c.

The third Ventricle is a very equivocal Term. The Antients understood, by this Word, a Cavity under the Fornix which they believed to be separated from the Basis of the Brain; and they have represented it with three Legs, that it might support the Brain, which lies upon it.

SILVIUS calls the third Ventricle a Canal found in the Substance of the Basis of the Brain, between the Infundibulum and the Passage which goes under the two posterior Pairs of the Tubercles of the Brain, towards the fourth Ventricle. Some Anatomists, having separated the Bodies of this second Pair of Tubercles, take the Space between them, which is owing to their Manner of Dissection, for the third Ventricle, which is, consequently, sometimes the Fissure above, and sometimes the Canal below; and some will have it to be the Space between the Fissure and Canal; which is likewise owing to the Rupture of the Parts already mentioned. We have, therefore, three third Ventricles; the second of which, alone, is the true one, the first and third arising entirely from the Methods of preparing the Parts. To these a fourth third Ventricle might be added, if the small Fissure under the Fornix could be looked upon as a Passage between the two anterior Ventricles and the fourth: But it is so small, and full of the Vessels and Glands of the Plexus Choroïdes, that I very much doubt whether there can be any Communication, that Way, between the anterior and

posterior Ventricles; especially since SILVIUS's third Ventricle is sufficient for that Purpose, and likewise answers the Design so perfectly well, that whatever goes from the lateral to the posterior Ventricle, must first fill the Infundibulum and this Canal.

Two Glands are supposed to belong to the Brain, tho' we know not if either of them resembles Glands in any Thing more than the Figure; and even that, when well examined, will be found to be different from what it is in the rest. The superior or pineal Gland is not like a Pine-apple, either in Brutes, or Man; and it is not known whether the inferior or pituitary Gland acts, in any Respect, on the Pituita.

The Plexus Choroïdes represents a vascular Texture, in which the Veins are seen very distinct from the Arteries, and the Distribution of each may be traced separately. The Name of Fornix gives the Idea of an arched or vaulted Part, which, however, is not to be found when looked for in a proper Manner: The Corpus Callosum, in the common Signification, means the white Substance of the Brain which appears when the two lateral Parts are separated: But as it entirely resembles the rest of the Substance of the Brain, there can be no Reason for giving a particular Name to one Part of this Substance.

There are but two Ways of coming at the Knowledge of a Machine; either to be taught the whole Contrivance by the Maker, or to take it to Pieces, and examine each Piece by itself, and as it stands in Relation to the rest. These are the only true Ways of learning the Contrivance of any Machine; but the Generality of Enquirers have thought that they had better guess at it, than be at the Pains to examine it thoroughly. They have satisfied themselves with observing its Motions;

tions; and on these Observations they have built Systems which they believed to be true; because, by their Help, they imagined they could explain all the Effects which they knew. They never considered that the same Thing may be explained in different Manners; and that the Senses, alone, are capable of informing us whether our Ideas be conformable to Nature.

As the Brain is a Machine, we must not flatter ourselves that we can discover the Contrivance of it by any other Means than are made Use of for knowing other Machines; and we have no Way left but to take it to Pieces, and consider what every Part is capable of in a separated and in a united State. In this Search, we may truly say, that few Anatomists have discovered any great Degree of Curiosity.

Chymistry has, in all Ages, found both private Men and Princes very ready to erect Laboratories; but few have pursued Anatomy with equal Ardour. This Neglect is not owing to Princes, among whom many have had Curiosity enough for such an important Part of Knowledge, to build magnificent anatomical Theatres, which they have often honoured with their Presence. But the Dissectors, being always willing to appear complete Masters of this Science, never have had the Sincerity to own, that any Thing still remained to be known; and, to conceal their Ignorance, have contented themselves with demonstrating what is to be found in the Writings of the Antients.



LECTURE IX.

Of the Office of the BRAIN.

THUS far we are taught, by Anatomy, concerning the Brain: It remains hence, that we explain the physiological Uses of these Parts. Every Nerve, therefore, which is irritated by any Cause, produces an acute Sense of Pain; and, if the Cause be great, those Muscles, to which the primary or communicating Nerves go, become immediately agitated with a convulsive Motion, which is stronger than their natural Motion, and not governed or restrained by any Power of the Will. The same Thing is likewise certain, if the Experiment be made soon after Death; as we see in the Heart, and other Muscles, of Animals.

Any Nerve being cut through, the Muscles, to which it is distributed, become paralytic, and generally waste away, or wither, gradually: But if the Nerve, so cut, performed any particular Sense; in that Case, whether it be cut through, or only compressed, the Sense is lost: But, by removing the Compressure from the Nerve, if the Structure of it was not destroyed by the Ligature, the Muscles regain their Strength.

All these Effects follow in such a Manner, that the Parts, most remote from the Brain, constantly suffer, from the Injury of the Nerve, without any Effect

Effect upon those Parts which are nearer to the Brain.

Experiments of this Kind have been made upon the recurrent Nerve, the eighth Pair, and the phrenic Nerve, together with those of the Limbs; and, lastly, upon the inferior dental Nerve of the fifth Pair.

But the Medulla of the Brain being vellicated, or variously irritated, dreadful Convulsions ensue throughout the Whole, and this without any Exception, whatever be the Part of the Brain so affected. The same Consequences also follow, if the spinal Medulla be irritated; but if the Encephalon itself be compressed in any Place whatever, there follows thence a Loss of Sense and Motion in some Parts of the Body, which must be the Part whose Nerves are detached from the affected or compressed Quarter of the Brain.

This is clearly evidenced from Experiments which have been made on disordered Parts of the Brain; as from those, for instance, in which the Origin of the Nerves are compressed, as in the Optic Nerves the Sight is extinguished, as the Hearing is from a like Affection of the auditory Nerve, or as the Motion of one Arm or Leg, or one Side of the Pharynx, is abolished by a Compressure of the Radices of their Nerves.

But in Injuries of the spinal Medulla it is still more evident that those Parts which receive their Nerves arising from the Place injured in the Medulla, are either convulsed if that be irritated, or rendered paralytic if it be compressed. But when any more considerable or large Portion of the Brain suffers a Compressure, either from Blood, Water, Schirrus, an impacted Bone, or other mechanical Causes; there follows perpetually, either a Disturbance of all the Faculties of the Mind, or else a Delirium, Vertigo, Madness, Stupidity, or an incurable Sleepiness: All which
Dis-

Disorders cease, upon removing the compressing Cause.

Lastly, If the Cerebellum, or Corpus Callosum, and especially the oblongated or spinal Medulla, entering the cervical Vertebrae, be injured in like manner; Death immediately follows: Because from those Parts, principally, arise almost all the Nerves of the Heart.

These Things being considered, there seems to be no Doubt but the Cause of all Motion, in the human Body, arises from the Brain, with its annexed Cerebellum and spinal Marrow; and that it proceeds hence, through the Nerves, to all the Muscles and moveable Solids of the Body. The Cause, therefore, of this Motion, cannot reside in the Parts themselves; because, otherwise, the moving Cause would continue to act, after being separated from the Brain: Nor would it be increased, by irritating the Brain; or weakened, by a Compressure of it.

Nor is it less evident, that all Sense arises from an Impression of the sensible Object upon some Nerve of the Body, through which Nerve, the Impression being conveyed to the Brain, when it is finally there arrived, represents some Idea to the Mind. It is therefore a false Position, that the Mind perceives immediately, in the nervous Branches or sensible Organs themselves: For this Opinion is confuted by the Pains which a Person will feel after a Limb has been cut off; and from the Interruption or Removal of all Pain by a Compressure of the conveying Nerve, with Disorders of the Senses from Affections of the Brain.

Whether or no this Faculty of perceiving impressed Objects by the Mind, and of ushering out the Motions which follow, either of Necessity, or from the Will, be privileged in common to the whole Brain, Cerebellum, and spinal Medulla, be-

because in those Parts are formed the Roots which are continuous with the Nerves, remains a Question. But we are not to believe this from the many Instances of Wounds, in several Parts of the Brain; from which the Senses have received no Injury, neither from Abscesses, which have considerably wasted the lateral Hemispheres of the Brain, &c.

From hence many Questions may arise: As, Whether there be any principal or particular Seat of the Brain, whence all Motion springs, and in which all Sensation ends; so as to be the Habitation or Residence of the Mind itself? Whether the said Corpus Callosum has a sufficient Communication or Connexion with the whole nervous System for such a Purpose? Whether there are truly any Instances of the fifth, seventh, or other Nerves, arising manifestly from this Part? Whether Wounds of the spinal Medulla are not equally or more fatal; when, at the same Time, we know it is not the Seat of the Mind; because, being compressed or destroyed, a Person will survive a long Time with all his mental Faculties entire*?

Whether or no the Seat of the Mind is in all those Parts which make the Beginning of each Nerve, in such a Manner, that the first Originations of all the Nerves conjunctly make the true common Sensory where all the Sensations are represented to the Mind, and all Motions arise, whether necessary or voluntary? We must confess, that this is highly probable. For the Origin of Motion does not seem capable of springing from any Part below the Source of the Nerve: And it would be begging the Question to suppose any

* Add, moreover, in Opposition to this, that, in Birds which have no Corpus Callosum, Wounds of the spinal Medulla are equally fatal with those in any other Part of the Encephalon.

Part of the Nerve, which is like the rest in its Fabric, to be either void of Sense or Motion. Nor can the Origin of Motion be placed higher than this ; for so it will fall within the Arteries, which have neither the Faculty of Sensation, or voluntary Motion. It therefore follows, that the Seat of the Mind, if it be material, must be where the Nerve first begins its Formation or Origin.

We come now to the Manner in which the Nerves become the Organs of Sense or Motion ; which, as it lies hid in the ultimate elementary Fabric of the medullary Fibres, seems to be placed above the Reach of Sense and Reason : But we shall, notwithstanding, endeavour to make this as plain as Experiments will enable us.

And, 1. It is demonstrated, that the Nerves arise from the Medulla of the Brain ; the Truth of which is manifest to the Eye in all the Nerves of the Brain, especially in the olfactory, optic, fourth, and seventh Pairs of Nerves, which continue their medullary Fabric at a considerable Distance before they are invested with the Pia Mater.

We must therefore next enquire what this Medulla is. That its Composition is fibrous, or composed of parallel Threads disposed longitudinally by the Sides of each other, appears from innumerable Arguments, especially to the Eye, in the Corpus Callosum, Striatum, and Thalami of the Optic Nerves ; but still more evidently in the Brains of Fish. That the Fibres of the Brain are continuous with those of the Nerves, so as to form one extended and open Continuation, appears, by Observation, very evidently, in the seventh, fourth, and fifth Pairs of Nerves.

But here begins a Controversy concerning the Nature of this Fibril, which, with others of the like Kind, composes the Substance of the Medulla and Nerves. That this is a mere solid Thread,

and only watered by a Vapour exhaling into the cellular Fabric, which surrounds the nervous Fibres, has been asserted by many of the Moderns: However, we are not allowed to receive this Opinion; for the following important Reasons.

The Cortex of the Brain is, on all Sides, vascular, and coheres so manifestly by an undivided and inextricable Continuation with the Medulla itself, that no one can either doubt or object against this Truth. Moreover, the most considerable Portion of the Blood is raised to this cortical Part of the Brain, to which the Medulla is always proportionable, both in its Growth and Dimensions. This being duly considered, I conclude, that the small Vessels of the Cortex, of which it is composed, are continuous with the Fibres of the Medulla, of which that Part of the Brain is wholly composed; and that therefore they cannot be solid impervious Fibres, because such a Fabric will occasion the great Quantity of Juices, sent to the Cortex by the carotid and vertebral Arteries, to return back useless, repelled from the solid Medulla. Again, from Analogy it follows, that the Cortex increasing proportionably with the Medulla itself, it plainly appears, that they must have both one and the same incrementive Cause, which Cause is the greater Force of the Heart; by which the sanguiferous Vessels are elongated. It follows, therefore, that the Medulla also must be composed of Vessels; which, in like manner, are distended by the same Force of the Heart.

Nor is such a Solidity of the nervous Fibres reconcileable with the Appearances which follow Wounds in the Nerves: For if an irritated Nerve require to be struck, and to vibrate like elastic Cords; it ought to consist of hard Threads, stretched out and held fast by their Extremities to certain firm or solid Bodies, with a considerable

Degree of Tension: For Cords which are either unstretched, soft, or not fixed or fastened at their Extremities, afford no Sound. But all the Nerves are, in their Origin, extremely soft, medullary, and very far from all Tension; and some of them continue thus soft throughout the whole Extent, so far as that goes; of which we have an Example in the olfactory Nerves, and in the soft Portion of the auditory Nerve, from which we ought more particularly to expect those Tremors which resemble Sound. Moreover, when the Nerves are hard, they always grow soft afterwards in the Viscera, Muscles, and Organs of Sense, before they operate; and therefore the nervous Fibres, being in no State of Tension, either in their Beginning or Ending, cannot be subject to elastic Tremors where they are fastened, in a more tense Manner, to the Heart, Pericardium, and great Arteries; because they are closely tied to the adjacent solid Parts, in their Progress, by the surrounding cellular Substance.

Finally, That the Nerves are very far from all Elasticity, is demonstrated by Experiments; in which the Nerves, cut in two, neither shorten nor draw back their divided Ends to the solid Parts, but are rather more elongated by their Laxity, and expel their contained Medulla in Form of a Pro-tuberance*.

Add to this, that the Force of an irritated Nerve is never propagated upwards, so as to convulse the Muscles which are seated above the Place of Irritation, altho' the Trunk of the nervous Cord may happen to be firmer and lighter in that

* The extreme Softness of the Medulla in the Brain, with all the Phenomena of Pain and Convulsion, leave no Room to suspect any Sort of Tension concerned in the Effects or Operations produced by the Nerves.

Part; which is a Consequence altogether disagreeing with Elasticity, whose Tremors propagate themselves in Rami, and other Bodies, every Way from the Point of Percussion.

These Arguments, therefore, serve to demonstrate, that there is a Liquor sent thro' the Brain, which, descending from thence thro' the Nerves, flows out to all the extreme Parts of the Body; the Motion of which Liquor, quickened by Irritation, operates only according to the Direction in which it flows thro' the Nerve: So that Convulsions cannot thereby ascend, because of the Resistance made by the fresh Afflux of the Fluid from the Brain.

Nor is the Experiment, made upon the phrenic Nerve, without its Force in this Argument; by which it appears, that, compressing the Nerve with a Motion downwards, the Contraction of the Diaphragm is increased; but, by compressing the Nerve upwards, the Motion ceases: From which it is evident, that, in the first Case, the natural Course of the new Liquid is quickened; and, in the latter, suspended. Nor can the Nerves ever act as Cords, when they never tremble by any Pressure, in whatever Direction they may be urged by the Finger.

I believe it is therefore certain, that the nervous Fibres are hollow, and perform their Offices not by their Elasticity, but by the Motion of their Juice.

Nor is the Objection, which arises from the Smallness of these Tubes, not visible by a Microscope, of any Force against the proposed Arguments; to which add, the Absence of a Swelling in a tied Nerve; which, in Reality, is not sufficiently true with other Arguments of the like Kind; which, indeed, shew the Weakness of our Senses,

Senses, but have not any Validity against the real Existence of a Juice or Spirit in the Nerves.

But concerning the Nature of this nervous Liquid there are many Doubts; for many of the Moderns will have it to be extremely elastic, and of an ætherial or electrical Matter: But the more reasonable Part. make it to be incompressible and watery, but of a lymphatic or albuminous Nature. Indeed it is not to be denied, but we have many Arguments against admitting any System that has been hitherto advanced; and electrical Matter is very powerful, and fit for Motion; but then it is not confinable within the Nerves, since it penetrates throughout the whole Body, to which it is communicated, exerting its Force upon the Flesh and Fat, as well as upon the Nerves. But, in a living Animal, the Nerves only, or such Parts as have Nerves running thro' them, are affected by Irritation; and therefore this Liquid must be of a Nature that will make it flow thro', and be contained within, the small Pipes of the Nerves.

An aqueous and albuminous Nature is common to most of the Juices in the human Body, and may be, therefore, readily granted to the Juice of the Nerves, like the former serous Water, which exhales into the Ventricles of the Brain from the same Vessels; also from the Example of a gelatinous or lymphatic Juice which flows out in cutting thro' the Brain in Fishes, and the larger Nerves of Animals; to which add the Tumor that arises in tied Nerves. But are these Properties sufficient to the wonderful Force of convulsed Nerves observable in Dissections of living Animals, and even in the lesser Insects; with the great Strength of mad and hysterical People? Whether or no this Difficulty is somewhat lessened from the hydrostatical Experiments of Attraction in

small Tubes, which, altho' it may explain the Strength and Motion; is, nevertheless, inconsistent with the Celerity.

Therefore, upon the Whole, it seems to be certain, that, from the Vessels of the Cortex, a Liquor is separated into the Tubes of the Medulla, which are continued with the small Tubes of the Nerves, even to their soft pulpy Extremities, so as to be the Cause of Sense and Motion: But the precise Nature of this Juice does not seem to be yet known. That it is extremely moveable, sufficiently appears, as well from the Nature of the Blood that goes to the Brain, as from the Effects or Appearances which follow from it, and from the Nature of Tenuity itself; by which Sir ISAAC NEWTON has observed that the Powers of Bodies are increased. But we must well distinguish this Juice from that visible thick Liquor that distils from the small Vessels which run in the cellular Fabric between the Filaments of the Nerves.

If it be asked, What becomes of this nervous Juice, which cannot but be separated and distributed, in abundance, from so large a Quantity of Blood, passing the Brain very swiftly, in Comparison of the slower-moving Blood, whence the Milk is separated in the Breasts, and the Urine in the lesser renal Artery, or by a Comparison with the mesenteric Artery? It may be answered, That it exhales, probably, thro' the cutaneous Nerves; and some have imagined, that it also exhales into the various Cavities of the Body; as that of the Stomach, Intestines, &c. but that it exhales into the sanguineous Vessels, does not seem very consistent with the Course of Nature, altho' it may be supposed to be taken up by the least absorbing Veins, which, by Degrees, open into the larger. That thus it may be resorbed from the Cavities of the Body, is not inconsistent; but whether it can

return again, within the same Nerves, to the Brain, so that the Nerves can resemble Arteries and Veins, as to the Course of their Spirits? or Whether Sensation arises from such a Return? Are, as yet, mere Conjectures.

But, then, what is the Design of so many Protuberances in the Brain? What are the particular Uses of the Ventricles, Nates, and Testes, with the Distinction of the Brain from the Cerebellum and spinal Medulla, with their opposite Sides, by so many transverse Bundles of Fibres? These still remain to be determined.

The Ventricles seem to be made of necessary Consequences, and towards the greater Use and Distinction of the Parts; and that the Corpora Striata, or Thalami, might keep their medullary Parts from cohering one to another, it was necessary for a Vapour to be poured between them: And the same is true with Regard to the Brain and Cerebellum. Perhaps, likewise, the Necessity of administering a Degree of Warmth to the close Medulla of the Brain, may be one Reason for these Cavities, by which the Arteries enter, and are distributed in great Numbers.

The Uses of most of the Protuberances we are not acquainted with, but have them yet to learn from Diseases and anatomical Experiments made on Animals having a Brain like that of Man. But, in these Respects, we have little Hopes of Success in Parts that are so small, and so deeply and difficultly situated, and hardly ever to be approached but by a Wound soon fatal.

Whether these Parts are so many distinct Provinces, in which our Ideas are impregnated? And whether this be confirmed by the protuberant Thalami of the Optic Nerve? Are, indeed, Questions. But then most of these Protuberances send out no Nerves at all.

As in the internal Communication of one Part with the other by Striæ or Ducts; that seems to conduce to the Advantage of Motion, and, probably, of Sense likewise. Some of these Communications join the Brain with the Cerebellum; others join the spinal Medulla with the Nerves of the Brain itself, as in the accessory Nerve; and most of them join the right and left Parts together, as in the anterior Conjunction before mentioned, and in the two posterior, in that of the Corpus Callosum, in the Striæ, betwixt a Process of the Cerebellum and Testes; to which add, the medullary cross Bars in the Medulla Oblongata and Spinalis. For, from this Structure, it seems manifestly to follow, as well as from numberless Experiments and Observations, that when the right Side of the Brain is injured, all the Nerves that belong, on the contrary, to the left Side of the Body, become diseased, or paralytic, and the reverse. Moreover, by this Contrivance Nature seems to have provided, that, in whatever Part of the Brain an Injury may happen, the Nerve that arises thence is, by this means, not always deprived of its Use. For, if the said Nerve receives its Fibres by communicating Bundles, as well from the opposite as from its own Hemisphere of the Brain; its Office may, in some measure, be continued entire by the Fibres which it receives from the opposite Side, even after those of its own Side are destroyed. Accordingly, we have numberless Instances of Wounds, and with a considerable Loss of Substance from the Brain, which yet have not been followed with Injury to any Nerve or mental Faculty*.

* Many other less Inequalities, Stripes, Protuberances, and Nerve-like Impressions, appear in the Brain, from mechanical Necessity, with the Pulsation of the Vessels, and the Pressure or Figure of the continuous incumbent Parts.

Whether or no there are distinct Provinces for the vital or spontaneous, and for the animal or voluntary Actions? And whether the Cerebellum furnishes the Heart and other vital Organs with Nerves, while the Brain supplies the Nerves that go out to the Organ of Sense and voluntary Motion? Indeed this, tho' an elegant System, is every where confuted by Anatomy. From the Cerebellum the fifth Nerve is manifestly produced; but then this goes to the Tongue, pterygoid Muscles, Buccinators, temporal Frontals, Muscles of the external Ear, Eye, and Nose, all which Parts are either moved voluntarily, or destined to Sensation.

Again, from one and the same Nerve, as in the eighth Pair, there are vital Rami sent to the Heart and Lungs, and others, that are animal and voluntary, to the Larynx; or sensitive in the Stomach. Lastly, the repeated Accounts of Injuries to the Cerebellum, being so suddenly and speedily fatal, are not altogether true: For that both Wounds and Scirrhusities of this Part have been sustained without any Fatality to the Patient, may be affirmed, by certain Experience, our own not excepted*.

But, if this elegant Hypothesis be not true, you will say, -What is the Cause of the perpetual Motion in the Heart, Intestines, and other Parts, which appear to want no Inclination of the Will to put them in Motion; and which, when in Mo-

* Nor is the Difference of the Brain, having a softer and finer Texture than the Cerebellum, any Thing very considerable. But why does the Brain itself appear insensible, and never transmit any Pressure upon it to the Mind? For this plain Reason, that all Sense is transferred to the Mind through the tubular Medulla of the Brain; which being either compressed, or otherwise occluded, no Impulsion on the Mind, even from its own Pressure, can be received into the Intellectuals.

tion, are not governable by any Power of the Mind? Why does the Pulsation of the Heart and Arteries continue in an Apoplexy after the nervous System is eclipsed; from whence all the voluntary Motions or Senses arise? Indeed the Cause is so simple, as to be, probably, the Occasion of its being almost universally overlooked. It is a general Principle with Nature, in the animal Fabric, for those Organs to operate perpetually that are most tender or irritable, which are most apt for Motion, and which are, lastly, under a perpetual Stimulus or Irritation. The Heart, then, is continually provoked to Action by the venal Blood which it expels. The same is also so easily and apt to be put in Motion, that it may be recalled, even after Death. Its muscular Fabric is very solid and reticular, and its Strength very considerable; from all which, therefore, it is extremely moveable; and its Irritability appears more especially, by the Experiments before mentioned.

Again, the Intestines, also, are extremely sensible; and, as will appear in their Description, full of Nerves, and, from the circular Position of their Fibres, liable to Contraction, as we see in all Parts that have such a Disposition of their Fibres: And, besides this, they are almost perpetually irritated to Motion, either by the Chyle or Aliments, by the confined Air which they include, or by the Bile sent from the Liver; to which add, the Pressure of the hard Fæces.

With Respect to Respiration, its Perpetuity has been spoken of before, the Alternations of which seems no otherwise explainable than from the Anxiety or Uneasiness which follows both after Inspiration and Expiration, both which call for a speedy Change. HALLER. Prim. Lin. Physiol.

N. B. The following Account is concerning the Ossification of the Brain of a Cow.

OBSERVATIONS.

What I take to be the Cerebellum, is, indeed, six Times, at least, bigger than the natural, and is bounded from the other by a Chink, running cross what I reckon its superior Part, and pretty deep, inclining forwards, and glazed on both Sides, as far as we can see down, as is the superior Surface and Sides of the whole Bone, and the posterior Part, which is tuberos, and the lateral Parts of the Base more prominent than the middle, which is somewhat hollow, and appears, as it were, carious; but all the other Parts, except those we reckon broken from the mammillary Process, are not only of a glazed Smoothness, but of a tarnished yellow Colour, as if the Pia Mater was ossified with the Brain.

Besides the Bigness of that Part, the Cerebellum. It is raised, much above its ordinary Height, to a Level with the other Part, and in its Center there is a particular Protuberance, as big as a Walnut; so that this Part is out of all Form; only its lower posterior Part consists of two gibbous Portions, as we find the Lobes of the Cerebellum, though these are much less.

But the Bigness and Figure of the Cerebrum are preserved greatly in the Ossification; for I found the greatest Resemblance in it to one of those with which I measured and otherways compared it: Both of them bulged along the Sides of the superior Surface, so that the Middle between the two was somewhat hollow, along which the Falx runs; and both of them from behind tapered forwards, much in the Form of a Wedge, for two Inches of the smaller Extremity, where they were much of the same Breadth. From the Chink to this, in the ossified Brain, the Length was

4,4 Inches, and in the fresh 4,3. At the Chink where the greatest Breadth was in the ossified Brain the Breadth was 3,7 Inches, in the other the posterior Part was in Breadth 3,8; in both the Breadth continued much the same, except for two Inches, where both turned so small; and the Weight of the Whole is one Pound, seven Inches and a Half, Merchant Weight. The Piece wanting was struck off by the Butcher; who, finding great Resistance to several Blows he had given with his Ax, to divide the Head, at length, increasing the Stroke, said, if the Devil was in it he should be into it; and with that Blow struck into the ossified Part; which so far shews that all was solid: For if it had not been so; but supported with the soft Brain, the Skull would have yielded as easily as in ordinary Cases.

Considering, then, the Resemblance it has to the Brain, and its Smoothness all over, except at some seemingly carious Parts, and at the fore Parts where it seems to have been broke off; it appears a very ill-founded Scepticism, to call in Question if it is the original Brain ossified; and should have expected worse Symptoms from such a Weight lying upon the Brain, than from its Ossification; since the soft Brains could not but have been bruised and torn, and its Membranes greatly fretted by its Neighbourhood.

It was certainly a great Misfortune that no Anatomist was acquainted with it on the opening of the Skull, to consider the State of the Membranes, the Rise of the Nerves, &c. but as it is, in my Opinion, we have a most certain Example how far the Muscles and Senses can continue in Office without the Brain, tho' not without Supplies; since, where the Brain was wanting, the Nerves have been found complete, which we find

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accompanied with the Pia Mater at their Exit, and to have a like Supply of Blood Vessels in the Whole of their Progress. But tho' they are thus supplied with Fluids; yet, from such Histories, we must give up the Correspondence of the Mind with the different Parts of the Body, if we confine it to the Brain; since, in such Cases, their Nerves have no Communication with its Seat; that is, with the cortical or medullary Substance of the Brain, to some distinguished Part of which they suppose the Mind confined. See SIMSON's Enquiry into the Vital Motion.

Five Pounds of Water was found between the Skull and Dura Mater, in the Falx and Cavities of the Brain*. TREW saw Water between the Skull and Dura Mater, between this last and the Pia Mater, and in the Ventricles of the Brain†.

BLANCHARD found about two Pounds of Water between the Dura and Pia Mater of a Fœtus about seven Months old; and also a Vesicle, which contained thirty Ounces of Water, adhering to the Membranes of the back Part of its Mouth which lie above the Vertebrae‡.

In a Boy between six and seven Years of Age, who died of a Hydrocephalus, there was found a small Cyst, full of Water, near the Surface of the Brain; the Ventricles distended with Water, and a Number of Hydatides in the Plexus Choroïdes§.

WEPFER says, that a Surgeon of Credit (PHILIP OCMELIN) assured him, that Hydatides in the

* BONLT. Sepulch. Anat. Lib. I. Sect. II. Obs. 45.

† A&T. Phys. Med. a. n. c. Vol. IV. Obs. 135.

‡ Opera, Vol. II. p. 135. See Cases of Hydatides in the Brain, in HALLER's Disput. Anat. Vol. II. p. 845. by BERGEN.

§ Medical Essays, Vol. III. Art. 23.

Brain was a common Disease among the horned Cattle in Switzerland, and shewed itself by a Giddiness, or Vertigo. When the Country People observe this, they strike the Head, behind the Horns, with a Hammer, to try if, by the Sound, they can distinguish any preternatural Hollow below; and, if they imagine they do, they immediately trepan the Part, put a Quill into the Hole, and suck out the Hydatides, if they lie near the Surface of the Brain; and so make a Cure: But if the Hydatides lie so deep in the Brain, that they cannot suck them out, they immediately kill the Beast. This Operation the Surgeon assured him he had seen done, with Success.

He afterwards tells us, that he himself saw it tried upon an Ox afflicted with Giddiness, when a large Number of Hydatides were sucked out; but the Vertigo still continuing, they killed the Beast, and, upon opening the Head, found a Number of Hydatides in the Ventricles of the Brain.

These Histories, tho' related by WEPFER, an Author of Credit, yet seem too much upon the Marvellous: And, at any Rate, the Uncertainty of the Existence of the Disease, from the Method taken to discover it, and the Danger of the Operation; will, in all Probability, prevent its being ever attempted on the human Subject.

Dr. LE CAT let out the Water of a Hydrocephalus, at different Times, by Help of a short broad-shouldered Trocar, the Cannula of which he let remain in the Wound. He covered its Orifice with a sticking Plaster, which he removed when he let out any of the Water, and put it on again when he thought he had evacuated a sufficient Quantity, and always afterwards bound up the Head tight with a capaline Bandage; notwithstanding which Precautions, the Child died the fifth Day after the Operation.

TULPIUS found five Pounds of Water in the Ventricles of the Brain of a Boy of five Years of Age. The Brain, at first, seemed wanting, but it adhered every-where to the Bones of the Skull, in Form almost of a thick Membrane; and in the following Observation he says, he has twice seen about two Pounds in one of the Ventricles, without any in the other.

VESALIUS saw a Case of a Hydrocephalus, where the Ventricles of the Brain were so much distended as to contain nine Pounds of Water.

HILDANUS took eighteen Pounds of Water out of the Ventricles of the Brain. The Ventricles contained twenty-four Pounds of Water in a Child of a Month old. I will not tell you how many Ounces he reckons to the Pound.

RUYSCH has sometimes seen these Tumors larger than the Head of a new-born Fœtus; and he remembers once to have seen one larger than the Child's whole Body. He says they communicate with the Ventricles of the Brain; and that the opening them destroys the Patient immediately. See Dr. MONRO on the Dropsy, from whom I have extracted these hydrocephalous Observations.

In the accurate Dr. KEILL's Experiments the vital Motions continued, in a Dog, above eight Hours after the medullary Part of the Brain was broken down into a Pulp; but when the medullary Substance of the Cerebellum was treated in the same Way, though they did not cease instantly, yet they began to fail in a few Minutes. When the Cerebellum was wounded, without touching the Cerebrum, the Heart's Motion failed sooner than when the Brain alone was wounded.

We meet with an Account, in the first Volume of the Memoirs of Surgery of PARIS, of a considerable

considerable Quantity of Cerebrum being evacuated by Suppuration, occasioned by a Wound.

It is not uncommon to find the Dura Mater ossified, but not the Cerebrum: However, we meet with Accounts (in Authors whose Veracity may be relied on) of Part of the Cerebrum being found ossified in the human Subject. See SPROEGELLIUS in HALLER's Opuscula Pathologica, &c.





LECTURE X.

Of the Muscles which move the Bones of the Shoulder on the TRUNK, and the HUMERUS on the SCAPULA.

SOME * of these Muscles are inserted into the Bones of the Shoulder, others move these Bones on the Trunk, without being fixed in them.

The Muscles which move the Scapula and Clavicula on the Trunk, by being inserted into them, are commonly the six following†:

1. **TRAPEZIUS**, a large, broad, thin, musculous Plane, situated between the Occiput and in-

* Here we resume the MYOGRAPHY.

† The Muscles which, without being inserted into the Scapula and Clavicula, move them upon the Trunk, and which therefore may be reckoned Assistants in the former, are two in Number, both belonging to that Class of Muscles by which the Os Humeri is moved on the Scapula; viz. the **PECTORALIS MAJOR**, and **LATISSIMUS DORSI**.

The Scapula, in particular, besides its Motions upon the Trunk, may also be moved, upon the Os Humeri, by means of some of the Muscles which move the Os Humeri on the Scapula, as we shall see hereafter.

In each Class of these Muscles I shall only describe those which are actually inserted into the Bones belonging to it, leaving to another Class the Muscles which move those Bones without being fixed to them. I shall in this Place, for instance, explain only the six Muscles first named, and refer the other two to the Muscles which move the Os Humeri on the Scapula.

ferior Part of the Back, and thence extending to the Shoulder in the Figure of a large irregular Square. From hence it took its Name; and, together with the Trapezius of the other Side, forms a kind of Lozenge.

It is fixed above, in the superior transverse Line of the Os Occipitis, by a thin Series of musculous Fibres, reaching to the Musculus Occipitalis, and appearing to cover that Muscle by a kind of Aponeurosis. It is fixed posteriorly to the five superior cervical spinal Apophyses by means of the posterior cervical Ligament, and immediately to the Extremities of the two inferior spinal Apophyses of the Neck, and all those of the Back.

These Insertions are by small and very short tendinous Fibres, except between the sixth cervical Apophysis and the third of the Back, inclusively; where these Fibres are somewhat longer, and form a small Aponeurosis in Form of a Crescent, which, with that on the other Side, represents a kind of Ellipsis pointed at both Ends: At the inferior spinal dorsal Apophysis these Insertions are likewise tendinous, and form a small triangular Lamella, which, together with that of the other Side, represents a Square.

From all these Insertions the musculous Fibres run in different Directions, and terminate, by one continued Insertion in about one third Part of the Clavicula, in the posterior Margin of the Acromium, and through the whole superior Labium of the Spine of the Scapula, all the Way to the small triangular Surface in that Spine, over which Surface the Fibres pass and slide freely, without being fixed therein.

The Directions of all these Fibres are these: The superior run obliquely downwards from the Occiput to the Clavicula; the next to these run a little less obliquely, and, together with some of

the superior, are fixed in the superior articulate Ligaments of the Shoulder, and in the Acromium. Here the Muscle forms a kind of Angle included in that formed by the Acromitum and Extremity of the Clavicle.

The rest of the Fibres that come from the Cervix, and those from the superior Spines of the Back, are fixed in the Spine of the Scapula, reaching within an Inch of the small triangular Surface, and becoming gradually less oblique, or more transverse, as they descend.

Lastly, The Fibres which come from all the other spinal dorsal Apophyses contract like Radii tending towards a Center, and are inserted into the Extremity of the Spine of the Scapula, passing over the small triangular Space, the superior being more or less transverse, and the rest becoming gradually more and more oblique, running from below superiorly.

This Muscle immediately covers the Splenius, or Mastoïdæus Superior, Part of the Complexus Major, the Angularis, Rhomboïdes, and Part of the Latissimus Dorsi. The common Insertion of the two Trapezii into the cervical Ligament, is the Reason that, in pulling either of them towards one Side of the Neck, the other will follow it a little beyond the spinal Apophyses.

2. RHOMBOÏDES, so named, as it was thought, from its resembling a Diamond when cut, is a thin, broad, and obliquely square musculous Plane, situated between the Basis of the Scapula and the Spina Dorsi.

It may be divided into two Portions, one superior, the other inferior; which sometimes appear separate. The superior Portion, which in some Subjects seems composed of two, is fixed, by an Insertion wholly musculous, into the two or three most inferior cervical spinal Apophyses, and partly in the posterior cervical Ligament; the inferior

Portion is fixed, by a tendinous Plane, in the three or four superior dorsal spinal Apophyses.

These two Portions, of which the inferior is by much the broadest, being united, are inserted into the Margin of the Basis Scapulæ, from the small triangular Space to the inferior Angle, the superior Portion covering a small Part of the Insertion of the Angularis.

This whole Muscle is covered by the Trapezius, and immediately covers the Serratus Posticus Superior, being connected to each of these Muscles by a filamentary or cellulous Substance.

3. ANGULARIS, thus named from its Figure, and commonly called LEVATOR SCAPULÆ PROPRIUS, is a long and pretty thick Muscle, about two Fingers in Breadth, lying above the superior Angle of the Scapula along the posterior lateral Part of the Cervix of that Bone.

It is inserted superiorly in the Extremities of the transverse Apophyses of the four first cervical Vertebrae, by four musculous Rami terminating in short Tendons, sometimes the second, sometimes the third, or both, and sometimes the fourth of these Rami is wanting; these Defects being formed by the Largeness of the rest.

From thence these Rami descend a little obliquely, and then, uniting, they are inserted into the superior Angle of the Scapula and the Margin of its Basis; thence to the small triangular Space, being there covered a little by the Rhomboïdes.

This Muscle is easily divided into two thro' its whole Length: It is covered by the Trapezius, and its Insertions into the Cervix are sometimes mixed with those of the adjacent Muscles.

4. PECTORALIS MINOR, so called from its Situation on the Breast, is a small fleshy Muscle, somewhat of a triangular Shape, situated at the superior, lateral, and anterior Part of the Thorax.

By

By its Basis it is inserted into the external Labium of the superior Margin of the second, third, fourth, and fifth true Ribs, near their Union with the Cartilages, by the same Number of Digitations, or separate musculous Portions, because of the Intervals between the Ribs; and for that Reason it has been called *Serratus Minor Anticus*.

From thence these Portions ascend, more or less obliquely, towards the Shoulder, and form a musculous Belly, which contracts as it passes before the two first Ribs; and then, becoming a short, flat, and broad Tendon, is inserted into the superior Part of the Apophysis Coracoïdes of the Scapula, reaching all the Way to the Apex of that Process.

This Muscle is covered by the *Pectoralis Major*, and adheres very closely to the external intercostal Muscles. The Digitations, commonly taken Notice of, cover and hide several others, by which the Number of Fibres, and Thickness of this Muscle, are increased: Its Tendon unites a little, at the Apex of the coracoïd Apophysis, with the Insertion of the *Coraco-Brachialis* and one Portion of the *Biceps*.

5. *SERRATUS MAJOR* is a broad, fleshy, and pretty thick Muscle, lying on the lateral Part of the Thorax between the Ribs and Scapula, by which it is covered. Its Figure is that of an irregular Square, its greatest Breadth being in the posterior Part, where it terminates, by Digitations of unequal Lengths, in a radiated Disposition, their Extremities describing an Arch, or Curve; and from these Digitations, which are like the Teeth of a Saw, its Name is taken.

It is inserted posteriorly into the internal Labium of all the Basis of the Scapula from the superior to the inferior Angle; thence running anteriorly wholly musculous, it increases gradually in Breadth, and is inserted into all the true Ribs, and

often into one or two of the false ones, by the same Number of Digitations.

The Insertion into the first true Rib is about five Fingers Breadth from the Cartilage, in the second somewhat less, in the third about four Fingers Breadth, in the fourth three, in the fifth two, in the sixth one, in the seventh one Half, and in the first false Rib two Fingers Breadth; but in all these Measures some Latitude is to be allowed: The Breadth of each Insertion into the Ribs is, at least, an Inch.

Tho' the Digitations of this Muscle gives it a radiated Appearance from the Scapula to the Ribs, yet these Radii do not at all lie in that Disposition, which, at first Sight, one would be apt to imagine: The Muscle is composed of two Lamellæ, one great, the other small.

The small one looks like a distinct narrow Muscle, closely adhering to the superior Margin of the great one: It is fixed, by one Extremity, under the superior Angle of the Scapula; and, by the other, to the first Rib by a small Insertion, and to the second by a broad one. This Plane is easily seen by turning the Scapula anteriorly, having first separated the Rhomboïdes; but, when that is turned posteriorly, the Pectoralis Minor being first cut off, this Plane does not appear, being covered and hid by the broad one.

The broad Plane may be divided into two Portions, one superior, the other inferior, adhering to each other by their Margins.

The superior Portion is thin, and takes up about three Quarters of the Basis of the Scapula, reckoning from the superior Angle; thence it contracts, by small Degrees, and forms two Digitations very like those of the small Plane, which they cover by their Insertions into the two first true Ribs,

Ribs, or into the second and third, and sometimes into all the three.

The inferior Portion is fixed in the lower Quarter of the Basis Scapulæ, whence it expands itself, by six or seven very long musculous Digitations, which decrease in Breadth as they descend, and are inserted, in the Manner already said, into the six or seven Ribs which follow the two first. The three first Digitations occupy almost all this Quarter of the Basis Scapulæ, the three last being fixed precisely in the inferior Angle; the Extremities of the three or four most inferior Digitations mix Fibres with those of the Obliquus Externus of the Abdomen.

The Direction of the Fibres and Digitations of the Serratus Major will be easily comprehended by recollecting; that the Ribs are inclined inferiorly, in different Degrees, from behind anteriorly; for which Reason, the Fibres of the superior Portion of the broad Plane cross the Ribs at less acute Angles than those below them; so that, in the natural Situation of the Scapula, the lowest of these Fibres, which ascend very obliquely, cross the third, fourth, and fifth true Ribs.

The superior Fibres of the inferior Portion of the broad Plane ascend proportionably more obliquely, and therefore cross more Ribs, and at more acute Angles, than the others which are less oblique; and tho' some of these run transversely, yet the Ribs, being oblique, must cross some of them, tho' in a lesser Degree: The lowest of these Fibres, or Digitations, descend a little, and, consequently, fall in more with the Direction of the Ribs, but not so much as might be imagined. These Digitations are very small and weak.

6. SUBCLAVIUS is a small oblong Muscle lying between the Clavicle and first Rib, situated in the Cavity of the Scapula, and hence it took its Name.

It is fixed, by one Extremity, in all the middle inferior Portion of the Clavicle, at the Distance of about an Inch from each Extremity; and, by the other, in the Cartilage and a small Part of the Bone of the first Rib: It seems likewise to adhere to the Extremity of the Clavicle next the Sternum by a kind of broad thin Ligament.

MUSCLES WHICH MOVE THE OS HUMERI ON THE SCAPULA.

The Muscles which are inserted into the Os HUMERI, and thereby move it upon the SCAPULA, are commonly nine in Number*; viz.

1. DELTOÏDES is a very thick Muscle covering the superior Part of the Arm, and forming what is named the Stump of the Shoulder: It is broad above, and narrow below, in a triangular Form; and it takes its Name from the Resemblance it bears to the Greek Letter Δ Delta; but, to make the Comparison thus, either the Letter or the Muscle must be inverted, and the Muscle flattened.

It is composed of eighteen or twenty small single Muscles, in an opposite Situation with re-

* The PECTORALIS MAJOR is inserted into the Trunk and Clavicle, the LATISSIMUS DORSI in the Trunk and Scapula, the DELTOÏDES in the two Bones of the Shoulder, and the other six Muscles in the Scapula alone.

Two of these nine Muscles may likewise move the Bones of the Shoulder on the Trunk; the other seven may move the Scapula on the Os Humeri.

The Muscles which, without being inserted into the Os Humeri, may, in some Circumstances, move it upon the Scapula, are two in Number, belonging to the Class of Muscles which move the Bones of the Fore Arm on the Os Humeri; viz.

1. BICEPS. 2. ANCONÆUS MAJOR, commonly called EXTENSOR CUBITI MAJOR.

Both these Muscles may likewise move the Scapula on the Os Humeri, as shall be observed in describing them.

spect

spect to each other, and united by middle Tendons, so that, taken all together, they form several penniform Muscles: The external Surface appears almost entirely musculous, and internally several of the Tendons are seen.

All these small musculous Portions are disposed in such a Manner, as to form a considerable Extent at the superior Part, whence they contract gradually in Breadth, till they terminate in a thick strong Tendon, by which the whole Muscle terminates in an Angle or Point.

It is fixed superiorly in the whole inferior Labium of the Spina Scapulæ, in the convex or long Margin of the Acromium, and in the third Part of the anterior Margin of the Clavicle next that Apophysis: It surrounds the Angle formed by the Articulation of these two Bones by a particular Slope.

From thence it descends above one Third of the Length of the Humerus, where it is inserted, by a thick Tendon, into the large muscular rough Impression below the osseous Ridge which goes from the great Tuberosity of the Head of the Bone, and forms the highest Border of the Sinus.

This Insertion seems to be immediately implanted in the Substance of the Bone, passing thro' the Periosteum, which is commonly the Case in all Insertions in these Kinds of Impressions, Eminencies, or considerable Tuberosities. It lies below that of the Pectoralis Major, and a little more anteriorly; some of the Fibres of this Muscle are fixed in the Aponeurosis common to all the Muscles which cover the Arm.

This Muscle may be distinguished into three principal Portions; one of which is fixed in the Spine of the Scapula, one in the Acromium, and one in the Clavicle. They are separated by a small

small Quantity of Fat or cellular Substance chiefly near the Basis of the Muscle.

The middle and strongest Portion descends almost directly to its Insertion into the Os Humeri; the lateral Portions seem to terminate sooner, but it is only because they turn internally towards the Bone, and thereby form the biggest and thickest Part of the Tendon: The anterior or clavicular Portion sends off some Fibres to the Bone before it reaches the Tendon.

The Portion fixed in the Spine of the Scapula sends posteriorly a thin Aponeurosis, which is strengthened by another tendinous or ligamentary Series of Fibres; this Aponeurosis is fixed in the Basis of the Scapula below the Spine, and thence is extended towards the inferior Angle; the other Series begins at the Spine, and ends, near the same Angle, at the Beginning of the inferior Costa: These, together with the great Tendon, seem to contribute to the Formation of the tendinous Expansion which covers the Muscles of the Arm.

At its superior Part this Muscle joins the Insertion of the Trapezius, and below, that of the Brachialis; anteriorly it joins the Pectoralis Major, being distinguished from it only by a small Line of Fat or of cellular Substance, and a small Vein called Cephalica. It covers the Head of the Humerus, and adheres to the capsular Ligament of the Articulation; and it likewise covers the Insertion of the Pectoralis Major.

2. PECTORALIS MAJOR is a large, thick, and fleshy Muscle, covering the anterior Part of the Thorax from the Sternum, where it is very broad, to the Axilla, where it contracts in its Passage to the Arm: It is naturally divided into two Portions; one superior and small, which may be termed clavicular; the other inferior and large, which may be called thoracic.

The

The clavicular Portion is fixed, by a musculous Infertion almost in Half the Clavicle next the Sternum, terminating under the Infertion of the Sterno-Mastoïdæus; thence it descends obliquely towards the Axilla, contracting by small Degrees, and ends in a flat Tendon, or tendinous Aponeurosis: In this Passage it borders on the anterior Margin of the Deltoides, from which it is distinguished only by a fatty or cellulous Line, and a small Vein named Vena Cephalica.

The thoracic Portion is broad, and, in some measure, radiated; it is fixed, by its anterior Circumference, in the lateral Part of the external Side of the Sternum, in this Side of the Cartilages, and in a small Part of the Bones of all the true Ribs, and of the first, and sometimes the second, false Rib. All these Infertions are like so many Digitations.

The Infertions into the Sternum terminate by a great Number of very short Tendons which run towards the Middle of the Bone, meeting and decussating those from the same Muscle on the other Side; the inferior Infertions are most distinctly digitated, and they mix with those belonging to the Rectus and Obliquus Externus of the Abdomen, there being likewise several Fasciculi of Fibres common to the Pectoralis with these Muscles: This Portion is also fixed to the Ribs by internal musculous Strata covered by the external Infertions, and forming, together with them, the Thickness of the Muscle.

From thence all the musculous Fibres contract in Breadth, and approach each other, in their Passage to the Arm; the superior Fibres descend, joining those of the clavicular Portion; those next them run less obliquely, the following more or less transversely, and the inferior ascend in the same Manner: This whole Portion terminates in a flat Tendon

Tendon connected to that of the small Portion, and folded back upon it in the following Manner :

The inferior musculous Fibres of the thoracic Portion, before they reach the Tendon, in their Passage to the Arm, are gradually turned inwards under each other, and then ascend behind the Extremities of the superior Fibres : By this Turn, the inferior Part of the Tendon answers to the superior musculous Fibres, the middle Fibres of both to each other, and the superior Part of the Tendon to the inferior musculous Fibres, and so on. Thus the Tendons of both Portions adhering closely by their flat Sides, and united at their Margins, form a double tendinous Plane, the Fibres crossing each other. The anterior or external Plane belongs to the clavicular Portion ; the internal or posterior to the thoracic Portion.

The Tendon, thus formed, is inserted, according to its Breadth, at about one fourth Part of the Length of the Bone from the Head, into the osseous Ridge of the great Tuberosity ; that is, in the external Margin of the Sinus, the Cavity of which it lines, in Conjunction with another Tendon, by a Stratum of very thin, shining, transverse Fibres : This Insertion lies between that of the Tendon of the Deltoïdes, which it touches, and that of the Latissimus Dorsi, which is on the other Side of the Sinus.

This Muscle, together with the Deltoïdes, sends off an Aponeurosis, which, joining that of the Biceps, is spread over the Muscles of the Arm ; It partly covers the Pectoralis Minor and Serratus Major, and, by its broad Tendon, it covers transversely the brachial Sinus and Tendon of the Biceps lodged there. Lastly, it forms the anterior Border of the Cavity of the Axilla, as the posterior is formed by the Latissimus Dorsi.

3. *LATISSIMUS DORSI*, is so called from its being a broad, thin, and mostly fleshy Muscle, lying between the Axilla; where it is very narrow, and the Back, on which it expands itself, by radiated Fibres, both in Length and Breadth, from the Middle of the Back all the Way to the inferior Part of the *Regio Lumbaris*; and from this Situation it has its Name.

Its Insertions (without reckoning that in the Arm) are partly tendinous, and partly musculous. In the first Place, it is only sometimes fixed in the inferior Costa of the Scapula, near the Angle, by a Fasciculus of musculous Fibres; and it is fixed, by an Aponeurosis, in the spinal Apophyses of the six or seven, and sometimes eight lowest dorsal *Vertebræ*, in those of all the Lumbar, the superior Spines and lateral Parts of the *Os Sacrum*, and in the external Labium of the posterior Part of the *Os Ilium*.

Besides all this tendinous Course, it is inserted, by musculous Digitations, into the last four false Ribs; these Digitations cover those of the *Serratus Inferior Posterior*, and mix with those of the *Obliquus Externus Abdominis*, there being sometimes Fasciculi of Fibres common to both Muscles. It is not always fixed to the lowest false Rib; and sometimes that Insertion is by a particular kind of Aponeurosis, which is pretty strong. It has also been seen fixed to the first false Rib, by a very small thin Digitation.

From all these Insertions the Fibres of this Muscle tend, in different Directions, to the Arm; at the Middle of the Back they are almost transverse, and become more and more oblique as they descend: Towards the Region of the Loins their Obliquity decreases again, and on the Ribs they are almost longitudinal. As they ascend they contract in Breadth, and under the Axilla terminate in a flat Tendon, turned almost in the same Manner

Manner as that of the *Pectoralis Major*, but more simply, and without any Adhesion between the two *Laminæ*: The superior Margin of this flat Tendon is turned internally, answering to the inferior or lateral Part of the Muscle; and the inferior Margin, which hides the other by crossing a little over it, answers to the superior or posterior Part of the Muscle.

The Tendon, thus formed, is fixed in the *Humerus* a little below the small superior Tuberosity, in the internal Margin of the osseous Sinus, the Cavity of which it also lines by a transverse smooth Expansion, nearly as is done by the Tendon of the *Pectoralis Major* from the other Margin; so that these two Tendons meeting, by their Extremities, in the Sinus, appear, in some measure, to be continued with each other, because the Tendon of this Muscle is not so broad as that of the *Pectoralis Major*.

The Tendon of the *Latissimus Dorsi* is accompanied by another flat Tendon belonging to the *Teres Major*, but it is inserted higher than that other Tendon, and nearer the Sinus; so that the inferior Margin of the Tendon of the *Latissimus Dorsi* may be said to encroach on the superior Margin of the other Tendon. These two Tendons communicate by some collateral Fibres, and are both strengthened by the same ligamentary *Frænum*, which descends from the Insertion of the *Subscapularis* below that of the *Teres Major*.

This Muscle is covered by the *Trapezius*, from the sixth to the last dorsal Vertebra, and covers the *Serratus Inferior Posticus*: Its Aponeurosis is narrow at first, but increases in Breadth as it descends between the Vertebrae and *Os Ilium*: It adheres strongly to that of the *Serratus Inferior Posticus*, and still more to the *Transversalis*, *Sacro-Lumbaris*, and *Longissimus Dorsi*. This Muscle, together
with

with the Pectoralis Major, forms the Cavity of the Axilla.

4. TERES MAJOR is a long, thick, flat Muscle, situated a little obliquely between the inferior Angle of the Scapula and the superior Part of the Arm. (This Muscle and the Teres Minor are so called because signifying round, tho' they are considerably broader than they are thick; because they come much nearer to that Figure than any other Muscle which moves the Humerus on the Scapula.)

It is fixed, by its posterior musculous Extremity, in all the large angular Surface on the external Side of the Scapula, in the inferior Costa of that Bone, and near the Angle; thence it advances, with longitudinal Fibres, towards the superior Quarter of the Humerus, terminating in a broad flat Tendon intermixed with some musculous Fibres, which, at the superior Margin, are continued all the Way to the Insertion, lying in the same Place with the Tendon.

It is inserted, by its anterior Extremity, at the inferior Part of the osseous Ridge of the small Tuberosity, along the Margin of the Sinus, almost opposite to, and sometimes a little lower than, the Insertion of the Pectoralis Major: It lines the Cavity of the Sinus by a tendinous Elongation, which joins that from the Pectoralis, and seems to be continued with it. This Insertion is below that of the Latissimus Dorsi, with which it communicates by a small Aponeurosis.

The Tendons of these two Muscles, the Teres Major and Latissimus Dorsi, lie almost in the same Plane, the superior Margin of the first ascending a little Way on one Side the inferior Margin of the latter, and the two Margins crossing each other in a small Degree. The Tendon of the Latissimus Dorsi lies posteriorly, and covers that of the Teres Major.

These

These two Tendons, near their Insertions, have a ligamentary Frænum belonging to them, which descends from the Insertion of the Subscapularis, and is inserted below that of the Teres Major: It covers the two Tendons, and keeps them close to the Bone.

5. TERES MINOR is a very fleshy Muscle, resembling the Teres Major, but narrower and shorter: It lies above the last named Muscle, between the Costa Inferior of the Scapula and the Head of the Humerus.

It is fixed, by one Extremity, to all the middle Part of the inferior Costa of the Scapula, and to the long particular Surface above that Costa, reaching from the great angular Surface near the Neck of the Bone; thence it runs wholly muscular, till it changes into a flat Tendon which is inserted into the posterior or inferior Surface of the great Tuberosity of the Head of the Bone, and likewise a little lower down*.

6. INFRA-SPINATUS, so named as being situated under the Spine of the Scapula, is a triangular, fleshy, and pretty broad Muscle, in some measure penniform, filling the whole infra-spinal Cavity or Fossa of the Scapula. It is fixed in the posterior Semi-infra-spinal Cavity or Fossa, and to the corresponding Part of the Basis of the Scapula.

Thence arise a great Number of short muscular Fibres, which run more or less obliquely, and end in a middle tendinous Plane, which terminates a little below the broadest Part of the Spine of the Scapula, under the Radix of the Acromium.

* It adheres very close to the inferior Margin of the Infra-Spinatus, and the Tendons of these two Muscles are united; for which Reason, the Antients confounded them, and did not look upon this as a particular Muscle. It is covered by the Deltoïdes.

Then the musculous Fibres, leaving the Bone, unite in one fleshy Mass, which, passing under the Acromium over the Articulation of the Head of the Humerus, and adhering to the capsular Ligament, terminates there in a flat broad Tendon; which, adhering likewise to the Capsula, is afterwards inserted into the greater middle Surface of the great Tuberosity of the Head of the Humerus. At the Place where the Fibres leave the infra-spinal Fossa under the Acromium, there is a great Quantity of fat or adipose Cells, between the Bone and loose Portion of the musculous Mass.

This Muscle appears double a little below the Spine, and towards the Basis of the Scapula, because of the middle tendinous Plane already mentioned; it seems likewise to be confounded with the Teres Minor, to which it is very closely joined. Its Tendon is united on one Side with that of the Teres Major, and on the other with that of the Supra-Spinatus; and it is covered by the posterior Portion of the Deltoïdes.

7. SUPRA-SPINATUS is a thick narrow Muscle; in some measure penniform, filling all the supra-spinal Cavity of the Scapula: It is fixed to all the posterior Semi-supra-spinal Fossa, and sometimes its Insertion reaches near the Cervix of the Bone. There the Fibres leave the Surface of the Bone; and being, as it were, supported by the fat or cellulous Substance, pass between the Acromium and Cervix of the Scapula, under the Arch formed by the Acromium and Extremity of the Clavicle, and under the Ligament between the Acromium and Apophysis Coracoïdes; being afterwards inserted into the superior Surface of the great Tuberosity of the Head of the Humerus, very near the osseous Sulcus. This Muscle is covered by the Trapezius.

8. **CORACO-BRACHIALIS** is a long Muscle lying on the Inside of the superior Half of the Humerus, that is, on the Side which answers directly to the Hemisphere of the Head of the Bone, and to the prominent internal Condyle. It is fixed superiorly to the Point of the coracoid Apophysis, between the Insertions of the Biceps and Pectoralis Minor, by a Tendon, which, as it descends, adheres to the Tendons of these two Muscles; afterwards it becomes musculous, and is inserted, by a broad thin Extremity with a small Mixture of tendinous Fibres, into the middle Part of the Humerus, close by the ligamentary Frænum of the Latissimus Dorsi and Teres Major. Its Insertion is continued down below the Frænum, near the internal inter-muscular Ligament, to which it likewise adheres.

This Muscle passes behind the Tendon of the Pectoralis Major; and as it is perforated in the Middle, to give Passage to a Nerve, it has, by some, been named *Perforatus CASSERII*, that Author being the first who gave a particular Figure of it. The other Name is taken from its Insertions.

9. **SUBSCAPULARIS** is a Muscle of the same Breadth and Length with the Scapula, of which it occupies all the internal or concave Side; and from this Situation it has its Name. It is thick, and composed of several penniform Portions, nearly in the same Manner with the Deltoides.

It is fixed in the internal Labium of the whole Basis, and in almost the whole internal Surface of the Scapula; its musculous Portions lying in the Intervals between the osseous Lines, when these are found. Near the Cervix they leave the Bone, and form a very broad Tendon which is inserted into the Surface of the small Tuberosity of the Head of the Humerus, close by the osseous Sulcus.

cus. The inferior Margin of this Tendon, probably, sends off the ligamentary Frænum mentioned in the Description of the Latissimus Dorsi, Teres Major, and Coraco-Brachialis.

This Muscle immediately covers the Serratus Major, being, in a Manner, inclosed between it and the Scapula: The superior Margin of its Tendon is joined to the inferior one of that of the Supra-Spinatus, except at the superior Part of the osseous Sulcus, where they give Passage to one Tendon of the Biceps; it likewise adheres to the capsular Ligament. The Tendons of the Supra-Spinatus, Infra-Spinatus, Teres Minor, and Subscapularis, being all connected by their Margins, form a Capsula that covers the superior Part of the Head of the Humerus.





LECTURE XI.

Of the Uses of the Muscles which move the Bones of the SHOULDER on the TRUNK, and the HUMERUS upon the SCAPULA.



THE Mechanism of the SCAPULA, in Relation to its Motions, and Changes of Situation, is very different from that of all other Bones of the Body, except the Os Hyoides; all the other Bones have solid Fulcra, or fixed Points, on which they are either moved, or fixed, by the Muscles: But the Motions of the Scapula, its Change of Situation, and Continuance in any one given Attitude, are brought about without the Help of any solid Fulcrum. The Muscles, alone, sustain and brace it down, in all its different Motions and Situations.

The Scapula has this Peculiarity, likewise, belonging to it; that it is the Fulcrum, or Basis, of all the Motions of the Humerus, and of some Motions of the Fore-Arm, and even of all the most violent Efforts made with these Bones, without being itself either moved, or fixed on any solid Basis.

We ought not here to have any Regard to the Clavicula, which seems to be only a kind of Os Accessorium in Man, and such Animals as can turn their fore Feet forwards to lay hold of any Thing,

Thing, almost in the same Manner as we turn the Hand in Supination and Pronation : In all other Animals no Claviculæ are to be found ; and therefore the Scapula is the principal, or rather the only Piece, of which the Shoulder is formed.

The Motions and different Situations of the Shoulder, in Men, depend chiefly on the Scapula. The Clavicula is pulled or pushed in different Directions by the other Bone, and entirely follows its Motions, serving, in some Circumstances, to regulate and limit them.

It is necessary to examine, with Attention, all the Motions of which the Scapula can be capable. It is not enough to say, that it may be raised, brought down, forwards, backwards, &c. which Language, as commonly understood, has given Rise to several false Ideas concerning the Action of the Muscles, to which the Motions of this Bone are attributed.

When we raise the Shoulder, this Motion is not ordinarily made, by a uniform Elevation of the Scapula, or, as it were, in a Direction parallel to itself : It is the Acromium which rises, and, while the superior Angle ascends, the inferior one is removed to a greater Distance from the Spina Dorfi. When the Shoulder is depressed, the Acromium descends more or less, the superior Angle ascends in Proportion, and the inferior one is brought nearer the Vertebrae.

The Shoulder can scarcely be brought forwards, or towards the anterior Side of the Thorax, without being proportionably raised ; and there is the same Difficulty in drawing it back without depressing it more or less. Every one may soon satisfy himself, as to the Truth of these Facts.

All these Attitudes are regulated by the Clavicula, the Angle which it naturally makes with the Scapula being lessened, or made more acute,

in raising the Shoulder, or bringing it forwards; and increased, or made more obtuse, when the Shoulder is depressed, or drawn backwards: Therefore, in most of the Motions, or Changes of Situation, performed by the Scapula, this Bone turns, more or less, upon its own Plane, and that in two contrary Directions. It cannot, indeed, be absolutely denied, but that the Scapula may be brought directly forwards or backwards, without being raised or depressed; but these are very constrained and inconsiderable Motions. In the first Case, the Acromium, together with the humeral Extremity of the Clavicula, is removed to a greater Distance from the Ribs; and, in the second, it is brought nearer to them.

We ought to consider, with particular Attention, the Situation and Motion of the Shoulder, when we raise it to support a Burden, or apply it to any other Resistance. It is the Acromium, alone, which is loaded and exposed, and with which we endeavour to overcome the Resistance, or support the Burden, without sinking under it. There must be Muscles proper for making all these Efforts, and capable of producing all the different Motions.

The three different Portions of the Trapezius may all have the same Use, according to what I have observed concerning the different Turns of the Scapula in its Motions: This Use is to raise the Shoulder, and keep it from sinking. The superior Portion draws the Acromium, and the Extremity of the Clavicula, upwards; the inferior Portion draws downwards the small Extremity of the Spine of the Scapula. By these two contrary Motions the Situation of the Spine is changed; and as the Acromium, by reason of its Articulation with the Clavicula, cannot move backwards while it rises; the small Extremity of the Spine must

must be removed to a greater Distance from the Vertebrae, while it descends.

The middle Portion, by its superior and longest Fibres, concurs with the Action of the superior Portion, more or less, according to the Extremity and Direction of these Fibres; the other Fibres, which become gradually shorter, and more transverse, partly join, in the same Action, by reason of the Obliquity of the Spine, into which they are inserted; and partly serve to regulate and limit the Removal of the Spine from the Vertebrae already mentioned.

The superior Fibres of this middle Portion may likewise, in some Circumstances, supply the Place of the superior Portion; as when we would raise the Shoulder, the Head being inclined to the same Side: For then the Fibres of the superior Portion, which are inserted into the Os Occipitis, have not Room enough to contract. The Obliquity of the superior Fibres of the middle Portion, and of the Spine of the Scapula, into which they are inserted, facilitates their Action in this Case.

The Use of the Trapezius, therefore, Regard being had to the Direction and Insertion of its Fibres, is, to raise the Shoulder; or, rather, to turn the Top of the Scapula upwards, and hinder it from sinking: But it is too thin, and consists of too few Fibres, to be able to overcome or bear up against some Resistances, without the Co-operation of the Serratus Major, as shall be shewn.

From this Account of the Use of the Trapezius, we see how improper it is to say, with the Generality of Anatomists, that the superior Portion of this Muscle draws the Scapula obliquely upwards, the inferior Portion obliquely downwards, and all the three Portions directly backwards. This Way of speaking is not only improper, but likewise leads us to imagine, that, by

the Action of the Trapezius, all the Parts of the Scapula are raised, depressed, or carried backwards. The Serratus Major raises the Shoulder, or Top of the Scapula, brings it forwards, and hinders it from sinking.

In all these it is the principal Actor; and it is impossible to conceive how Labourers raise and support, by the Shoulder alone, the heavy Burdens with which they are loaded, without the Assistance of this Muscle.

The Thickness, Length, and particular Disposition of its Fibres, but, above all, the Insertion of the greatest Portion of them, near the Angle of the Basis Scapulæ, sufficiently prove what I advance; and the general Action of the radiated Portions is, to draw the inferior Angle from the Spina Dorsi towards the lateral Parts of the Thorax. The superior and strongest Portions pull this Angle superiorly at the same Time, and, consequently, raise the Acromium, which cannot be pushed forwards, by reason of its Connexion with the Clavicula.

These superior Portions cross over the greatest Part of the true Ribs; and, accordingly, in raising great Burdens, we find ourselves obliged to hold in our Breath, that is, to lessen Expiration as much as we can, in order to fix the Ribs, and hinder them from sinking, that they may serve for a solid Fulcrum to this Muscle, in Proportion to the Force with which it acts.

The next Portions run according to the Length of the Ribs, and, consequently, do not much constrain them, in their reciprocal Motions, not being in a Condition either to raise or depress them; and the most inferior and weakest Portions are only Assistants to the rest, in bringing the inferior Angle of the Scapula anteriorly towards the lateral Parts of the Thorax. The small Distinct
Plane,

Plane, before described, is not an Assistant to the radiated Portions or inferior Part of the great Plane; it seems designed to regulate the Motion of the superior Angle posteriorly and anteriorly, while the inferior is carried forwards and upwards by the radiated Portions; and, when their Action ceases, to bring the Scapula back to its natural Place. The superior Portion of the great Plane is an Assistant partly to the radiated Portion, and partly to the small Plane, according to the different Places of its Insertions into the Basis of the Scapula.

From all this we see, that the principal Use of the Serratus Major is to raise the Shoulder, and not for Respiration. When both Planes act together, this Muscle may, in some Cases, bring the Shoulder directly forwards, or, rather, hinder it from going back; as when we push any Thing with great Force directly forwards with the Hand, especially when the Arm is extended.

A whole Treatise might be written on the numerous Phænomena observable in the Motion of the Shoulder by the Action of this Muscle. Some of these shall be mentioned in describing the Uses of the other Muscles which move the Shoulder; as we have explained, more at length, why this Muscle can have no Part therein, in the Lecture upon Respiration, &c.

According to the Insertions and Direction of the Rhomboïdes, its general Use must be, to draw posteriorly and superiorly the sub-spinal Portion of the Basis Scapulæ. It is likewise a Moderator to the Trapezius and Serratus Major, when they raise the Shoulder, or carry the Acromium superiorly; and it brings the Scapula back to its natural Situation, when the Action of these Muscles ceases.

It may draw the Scapula directly backwards, if the inferior Portion of the Trapezius acts at the same Time. For as this Portion draws obliquely inferiorly, and towards the Spina Dorsi, and the Rhomboïdes obliquely upwards, and towards the same Spine; the Joint Action of both must produce a Motion directly backwards, as it happens when we pull back both Shoulders equally, in order to disengage them.

It may, likewise, together with the radiated Portion of the Serratus Major, draw the Basis of the Scapula directly backwards. This, however, is but an inconsiderable Motion, and not so easy as the rest: For the Serratus Major contributes to it only in Proportion to the Action of the Rhomboïdes, which is but very small; and, in this Case, the Acromium can rise but a very little Way.

The Angularis, by its Insertion into the superior Angle of the Scapula, moderates the Descent of that Angle, while the Trapezius and Serratus Major raise the Acromium; afterwards, when these two Muscles cease to act, the Angularis raises the superior Angle, and, by that means, depresses the Acromium, much in the same Manner as was observed of the Rhomboïdes.

From hence we see, that this Muscle is very improperly called Levator Scapulæ Proprius, since it does not raise, but depresses, the Scapula. That Name would agree better to the Serratus Major. Whether this Muscle can have any Share in moving the Cervix, the Scapula, into which it is inserted, being kept immoveable by other Muscles; cannot, at present, be determined.

The Pectoralis Minor assists the Rhomboïdes and Angularis as Moderator of the Action of the Trapezius and Serratus Major, in turning the Point of the Acromium upwards, the superior Angle

Angle downwards, and the inferior Angle forwards; it is likewise an Assistant to the Rhomboïdes and Angularis, in restoring the Scapula to its natural Situation when the Trapezius and Serratus Major cease to act, by drawing downwards the Apophysis Coracoïdes, into which it is inserted.

It has been reckoned among the Muscles employed in Respiration by some, who imagine, that, in some Cases, the Shoulder may be kept so steady, as that this Muscle may be able to raise the Ribs, in which it is fixed: But as the Serratus Major, which must principally be employed in keeping the Shoulder in a fixed Position, is partly inserted into the same Ribs, and, in this Action, must keep them depressed; it will be impossible for the Pectoralis Minor to raise them.

The Subclavius can have no other ordinary Use but to bring down the Clavicula, after it has been raised, together with the Acromium, by the Action of the Trapezius and Serratus Major. It may likewise hinder not only the Clavicula, into which it is inserted, but likewise the Acromium, from rising, especially when assisted by the Pectoralis Minor, Rhomboïdes, and Angularis.

When we stand, or sit, the Weight of the Arm alone seems to be sufficient to depress the Clavicula, when raised; and therefore, in this Case, there would be no Occasion for the Subclavius to act upon the Clavicula, nor for the Pectoralis Minor, Rhomboïdes, and Angularis, to act upon the Acromium: But when we lie, or are situated in any other Manner, the Weight of the Arm has no such Effect. And, in these Cases, the four Muscles become more or less necessary.

The Subclavius, therefore, is a proper Depressor of the Clavicula, and an assistant Depressor of the Acromium, or of the Shoulder in general, together

gether with the Pectoralis Minor, Rhomboïdes, and Angularis; all which, in their Turns, assist the Subclavius in its Action on the Clavicula.

We cannot conceive what has led several great Anatomists to rank this among the Muscles of Respiration, since it is inserted not only into the Bone, but into the Cartilage of the first Rib; since this Cartilage is not articulated with the Sternum; but connected to it as immoveably as to the Bone of the Rib, by its other Extremity; and, lastly, since this Cartilage is much shorter, broader, and less pliable, than the Cartilages of all the other Ribs, of equal Thickness.

USES OF THE MUSCLES WHICH MOVE THE OS HUMERI ON THE SCAPULA.

The Deltoïdes, from the Disposition of its Insertions into the Scapula and Clavicula, may raise the Arm, or separate it from the Ribs, not only directly, but likewise obliquely, many Ways.

The Arm being lifted directly upwards, the lateral, anterior, and posterior Portions of this Muscle may bring the Arm, so raised, forwards and backwards. In that Case, the middle Portion of the Muscle is the principal Mover, and the lateral Portions are the Directors, or collateral Muscles. When we stand, or sit, this Muscle alone, without the Help of any other, regulates the Depression of the Arm, by means only of the Weight of the Part. This Depression is brought about merely by the Relaxation of this Muscle, proportionable to the Degree of Velocity it has acquired, according as the Will directs. But when we lie, other Muscles are necessary, to bring the Arm near the Ribs, when the Deltoïdes has carried it to any Distance from them. Yet, even in this Case, when the Arm is laid close to the Ribs,

Ribs, the lateral Portions of the Deltoides may press it harder against them, by reason of the Change of Direction of the Fibres in this Situation. By reason of the Multiplicity of musculous Fibres, this Muscle must act with a very considerable Force.

The Latissimus Dorsi serves, in general, to bring down the Arm, when raised; and this it does chiefly by its inferior Portion: By the same Portion, and the Connexion of the Scapula with the Humerus, it serves to depress the Shoulder, or maintain it, in that Situation, against any Force that endeavours to raise it; as when we lean upon the Elbow in sitting, or walk upon Crutches.

By its dorsal Insertion, and the Passage of its Tendon, on the interior Side of the Humerus, and by its Insertion anteriorly into that Bone, it may turn the Arm round its Axis, by Anatomists called Rotation; as it happens when, having bent our Fore-Arm, we turn it behind our Back.

By its Insertion into the Crista of the Os Ilium and the false Ribs, it becomes necessary to raise the Head laterally to one Side, when we lie on the other. For the Shoulder being then depressed, and brought near the Thorax, the Clavicula becomes the fixed Point of one or two of the Muscles which raise the Head in this Situation.

Any Person may make the Experiment in Bed, by lying at full Length on his Side. For if, while he raises his Head, in this Posture, he lays his Hand on the anterior Margin of this Muscle, he will find it considerably extended; and also, that this Tension ceases whenever he ceases to lift up his Head.

The Connexion of this Muscle with the false Ribs is the Cause of that Uneasiness which we find in Breathing when the Arm is pulled strongly down-

downwards to press upon any Thing; as when we seal a Letter, or lean upon a short Cane, the Fore-Arm being extended. The small Portion inserted into the inferior Angle of the Scapula may be an Assistant to the Teres Major, as will be shewn.

This Muscle sustains the Weight of the whole Body, when, with Arms raised, we hang by the Hands; as when we grasp the Branch of a Tree in climbing. It performs the same Office when we either sit or stand with the whole Arm more or less extended horizontally, and press the Hand from above downwards against any Resistance; as when we support ourselves, in this Situation, by a very long Cane grasped by the Hand, or lay hold of the upper Part of a Halbert, and press the lower End strongly against the Ground. These three last Uses cannot, however, be well executed by this Muscle alone, without the Assistance of the Pectoralis Major.

The Pectoralis Major serves, in general, to bring the Arm near the Ribs, press it strongly against them, and to carry it towards the anterior Part of the Thorax. This last Motion may be performed without separating the Arm from the Ribs; as when one Arm is crossed over the other: And it may likewise be done with the Arm raised; as when the Hand of one Side is laid over the Shoulder of the other Side: And, in that Case, the anterior Portion of the Deltoïdes may assist this Muscle in great Efforts.

By means of the Fold in its Tendon, the superior and inferior Portions may act as two distinct Muscles; that is, one may act without the other. The superior musculous Portion, which answers to the inferior Portion of the Tendon, serves, chiefly, to raise the Arm forwards.

The inferior musculous Portion which is connected to the superior Portion of the Tendon, by its Insertion into the Humerus, and by the Connexion of that Bone with the Scapula, may depress the Shoulder, or keep it from rising, with more or less Force, much after the same Manner as the inferior Portion of the Latissimus Dorsi; the inferior Portions of these two Muscles concurring in the same Use: As when we support ourselves upon our Hands, or walk with Crutches, as has been already said.

It is likewise by means of the inferior Portion of this Muscle that we can suspend the whole Body, by the Hands grasping the Branch of a Tree in climbing, &c. In this Case, also, the Latissimus Dorsi acts in Concert with the Pectoralis; and this Co-operation Painters and Carvers have taken Care to express in Crucifixes.

The inferior Portion of this Muscle cannot perform these two Uses without the Assistance of the Muscles of the Abdomen; which, by pulling the Ribs inferiorly, become, in a Manner, a Continuation of the Insertion of this Portion. The same Thing may be observed concerning that Part of the inferior Portion of the Latissimus Dorsi that is inserted into the false Ribs.

The Uses of the superior Portion and all the Body of the Pectoralis, cannot take Place without the Co-operation of the Muscles that move the Scapula on the Trunk, especially the Serratus Major; because the Scapula must be securely fixed before it can be a Fulcrum for the Humerus to move upon. The same Thing is to be observed concerning the Deltoïdes, and all the other Muscles which move the Humerus on the Scapula.

The Teres Major, by being inserted into the Humerus in a Direction parallel to the Latissimus Dorsi, becomes a Congener to the superior and

posterior Portion of that Muscle; and, accordingly, moves the Humerus, in the same Manner, with it.

It turns the Bone round its Axis when the Fore-Arm is carried behind the Back; it likewise pulls the Arm directly backwards, without moving it round its Axis: But neither this Muscle, nor the Latissimus Dorsi, can perform this simple Motion, because of the incurvated Direction of their Tendons, without the Assistance of other Muscles, which, like Antagonists, prevent the Rotation already mentioned; and of this Number is the Teres Minor.

The Nearness of the Tendon of this Muscle to that of the Latissimus Dorsi deserves our Attention. They are both inserted, according to their Breadth, into the same Line, along the Margin of the osseous Sulcus of the Humerus, opposite to the Insertion of the Pectoralis Major, in the other Margin of the same Sulcus. These two Tendons cross each other in the same Plane; that of the Teres Major running obliquely from above downwards; and that of the Latissimus Dorsi obliquely from below upwards. By this Disposition, these two Tendons resemble, in a great measure, the Duplication or Fold of the Tendon of the Pectoralis Major; and therefore the Teres Major may become a particular Antagonist to the superior Portion of the Pectoralis Major, and the Latissimus Dorsi to the inferior Portion; and both Muscles, taken together, may be a common Antagonist to the Pectoralis Major when that whole Muscle acts at the same Time.

It has been observed, that these two Tendons are bound down by a ligamentary Frænum, which, from the Insertion of the Sub-Scapularis, descends below that of the Teres Major; and that this Frænum covers the two Tendons, and braces them

them down close to the Bone. The Use of this Frænum seems to be to prevent the Separation of the two Tendons from the Margin of the Sinus, in violent Rotations of the Arm.

The Teres Major may likewise move the Scapula on the Humerus, by drawing the inferior Angle downwards, and bringing it nearer the Arm; but, in order to this, the Arm must be kept immoveable, by some considerable Force or Resistance; as when in standing, with the whole Arm hanging down, the Hand supports a great Weight. By this Action the Teres Major may likewise assist in raising the Shoulder, or hindering it from sinking.

The Coraco-Brachialis brings the Arm to the anterior Side of the Thorax, raising it at the same Time; and, in this Case, it may be reckoned a Congener, or Assistant to the Pectoralis Major in great Efforts, and may perform the same Motion by itself, when no great Force is necessary: As when the whole Arm hangs down, and is moved backwards and forwards like a Pendulum; the Motion forwards being performed by the Coraco-Brachialis, and the Motion backward by the Teres Major, its Antagonist.

This Muscle may likewise move the Scapula on the Humerus, kept firmly depressed; as when, sitting in a Chair, we take fast hold of the Edge of it with the Hand. In this Case, the Coraco-Brachialis may bring the Acromium downwards, and the inferior Angle of the Scapula near the Vertebrae: It serves, likewise, to bring the Arm to its former Situation, after it has been turned by the Latissimus Dorsi, in order to apply the Hand to the Back; and then it turns the Humerus upon its Axis, in a contrary Direction to that given it by the other Muscle.

The Supra Spinatus is commonly supposed to concur with the Deltoïdes, in lifting up the Arm; this Muscle beginning that Action, and the Deltoïdes continuing it. But besides that this Muscle is very small, it seems to be too near the Articulation of the Head of the Humerus to be able to raise the whole superior Extremity, which is of a considerable Weight and Length. It has, however, two other very remarkable Uses: When the Arm is raised from the Thorax to the Head, by the Action of the Deltoïdes.

To understand these Uses, we ought to remember, 1. That the cartilaginous convex Part of the Head of the Humerus is much larger than the glenoid Cavity of the Scapula. 2. That the most superior Part of this Convexity lies out of the Cavity when the Arm is depressed, or near the Ribs. 3. That the orbicular Ligament of the Joint is very broad, being proportioned to the Distance between the Margins of the convex Part of the Head of the Humerus, and of the glenoid Cavity of the Scapula; and that, therefore, it cannot check the Humerus, in any of its Motions.

From hence it is plain, that the Strength of the Deltoïdes, at the first Instant of its Action to raise the Arm, would thrust the Head of the Humerus superiorly out of its Cavity, if somewhat did not supply the Place, either of an osseous Fulcrum, or ligamentary Frænum. The Curvature of the Acromium is of no Use in this Case; for the Bone must be first luxated before it can reach so far, and the adjacent Parts must suffer a Friction, and even a Contusion, which would be very prejudicial.

It is likewise evident, that the broad orbicular Ligament would be very apt to be entangled and bruised between the Margins of the two articulated Bones, were not this Inconvenience prevented,

vented, by some Means or other; because it is not elastic enough to contract itself in Proportion as these two Margins approach each other.

The Supra Spinatus answers both these Ends. When it contracts its Tendon, which crosses the convex Part of the Head of the Humerus to be inserted into the superior Surface of the great Tuberosity, it presses very strongly on the Head of the Bone, thereby supplying the Place of a Fulcrum, and hindering it from rising during the Beginning of the Action of the Deltoïdes; and in this Action it is assisted by the ligamentary annular Ligament mentioned in the Description of the fresh Bones. In this Muscle there is likewise a singular Contrivance to prevent the second Inconvenience.

Its Tendon is a kind of Aponeurosis, which adheres closely to the exterior Side of the orbicular Ligament; and, when we examine it narrowly, we observe, that several of its Fibres do not go so far as the Head of the Humerus, but are gradually inserted into the exterior Surface of the Ligament. These tendinous Fibres are continuous with those which lie nearest the Bone, or Bottom of the supra spinal Cavity of the Scapula.

This Portion may therefore be reckoned a distinct Muscle belonging to the orbicular Ligament, notwithstanding its close Union with the other Portion which is inserted into the Humerus. And, indeed, we might very justly establish a new Species of Muscles by the Name of articular Muscles, which belong chiefly to the capsular Ligaments of those Joints which have considerable Degrees of Motion; several Examples of which we shall meet with hereafter.

The Mechanism of this Kind of Muscles consists in this: The Extremities of the Tendons are inserted very obliquely into the Surface of the Li-

gament, and the Fibres occupy a greater Space there than in the Body of the Tendon; and they are commonly the most internal or deepest and shortest Portions of the ordinary Muscles inserted near the Articulations.

The Use of these Muscles, or Portions of Muscles, is, to pull the orbicular Ligaments uniformly, and thereby prevent their running into irregular Plicæ, and being entangled between the two articulated Bones.

The Infra Spinatus being inserted, by its Tendon, into the middle Surface of the great Tuberosity of the Humerus, must perform different Motions, according to the different Situations of that Bone. If it acts while the Arm hangs down parallel to the Trunk of the Body, it may move the Humerus round its Axis from before externally; and, consequently, if the Fore-Arm be, at the same Time, bent, it will turn the Hand from the Body: If, while the Arm is kept raised by the Deltoïdes, the posterior Portion of that Muscle draws the Arm posteriorly; the Infra Spinatus has the same Use, with respect to the orbicular Ligament, as the Supra Spinatus, already described. And as these two Muscles adhere closely by the Margins of their Tendons, they may, in some measure, co operate in their Action on that Ligament. When the Arm, raised in the Manner already said, is strongly pulled anteriorly by the Pectoralis Major, a considerable Force is necessary, to prevent the Head of the Humerus from being thrown posteriorly out of its glenoid Cavity. The Structure of the Infra Spinatus, and the Number of its Fibres, which is much greater than in the Supra Spinatus, fit it for answering this Purpose; in which it is likewise assisted by the flat, broad, thin Ligament, mentioned in the Description of
the.

the fresh Bones. This Muscle may likewise assist the Teres Major in great Efforts.

The Use commonly ascribed to the Subscapularis, of pressing the Arm against the Ribs, is without Foundation. When the Arm hangs down in its natural Situation, this Muscle may turn it round its Axis from without anteriorly; as it happens when, in this Situation, we beat the Breast with the Fore-Arm bent; and it likewise strongly assists the Latissimus Dorsi when we turn the Hand behind the Back. If, when the Arm is raised, it be moved posteriorly, as in giving a back Stroke with the Elbow, or Fist; the Subscapularis hinders the Head of the Humerus from being luxated anteriorly; for which Purpose it is well fitted, both by its Structure and Number of Fibres; this Motion sometimes being performed with great Violence. It may likewise, by means of the Nearness and lateral Union of its Tendon with that of the Supra Spinatus, assist that Muscle in keeping the Head of the Humerus in the glenoid Cavity, when the other Extremity of the Bone is raised.

The Teres Minor may turn the Arm, when depressed, round its Axis, from before externally; as it happens when the Fore-Arm, being bent, and applied to the inferior Part of the Thorax, is removed from thence, without moving the Elbow from the Side. This Rotation is in a contrary Direction to that performed by the Subscapularis and Teres Major. This Muscle may likewise pull the Arm directly backwards, whether raised or depressed; but, in order to this, the Subscapularis must act, at the same Time, as a Moderator to prevent the Rotation. The Co-operation of Muscles is necessary in all particular Motions, but in some more than others.



LECTURE XII.

Of the Muscles which move the Bones of the FORE-ARM on the HUMERUS, and the RADIUS on the ULNA.



THE Muscles which move the Bones of the Fore-Arm on the HUMERUS, are commonly reckoned six in Number: Two Flexors, lying on the anterior Side of the Arm, called BICEPS and BRACHIÆUS INTERNUS; and four Extensors, situated on the posterior Side, named EXTENSOR LONGUS, EXTENSOR BREVIS, BRACHIÆUS EXTERNUS, and ANCONÆUS.

The Terms of BRACHIÆUS and EXTENSOR BREVIS are now become so indeterminate, as to be often taken for one another; as likewise those of BICEPS EXTERNUS and BRACHIÆUS EXTERNUS, which the Moderns have substituted in the Room of the former.

Of the two anterior Muscles, WINSLOW names one simply BRACHIÆUS, with the Antients, the other BICEPS, or CORACO-RADIALIS; and he calls all the four posterior Muscles ANCONÆI; distinguishing them, afterwards, by the Epithets of MAJOR, MINOR, EXTERNUS, and INTERNUS*.

* These four Muscles might be reduced to two, the ANCONÆUS and TRICEPS; which last may again be distinguished by MAJOR, LONGUS or MEDIUS, EXTERNUS, and INTERNUS.

Sometimes the ANCONÆUS EXTERNUS, and sometimes the INTERNUS, is called EXTENSOR CUBITI BREVIS, or BRACHIÆUS EXTERNUS.

1. **BICEPS, or CORACO-RADIALIS**, is a double Muscle, composed of two long musculous Portions, more or less round, lying by the Side of each other, on the middle anterior Part, and a little towards the internal Side of the Arm: These two Portions are separated superiorly, each of them terminating in a small Tendon. As they descend they become contiguous, and afterwards closely united by one common broad Tendon. The Antients, who looked upon the two superior Extremities as two Heads, gave this Muscle the Name of Biceps; and, from its Insertion, we call it **CORACO-RADIALIS**.

It is fixed, by one of the superior Tendons, in the Apex of the coracoïd Apophysis of the Scapula, on one Side of the Tendon of the Coraco-Brachialis, which adheres very strongly to it. This Tendon of the Biceps is broader, shorter, and situated more internally, than the other; the musculous Portion belonging to this Tendon is longest, and, consequently, ascends more superiorly.

The other superior Tendon is smaller and longer than the former, and the musculous Part belonging to it shorter, and more compounded: This Tendon is lodged in the osseous Sinus of the Humerus, being surrounded by a membranous Vagina continued from the capsular Ligament, and terminating at the musculous Portion, where it is entirely closed.

At the superior Part of the Sinus the Tendon runs between the Insertions of the Tendons of the Supra Spinatus and Subscapularis, passes immediately over the Head of the Bone within the capsular Ligament; then, leaving the Articulation between the two Tendons just mentioned, is covered by another short Vagina, and inserted, above the glenoïd Cavity, into the superior Impression of the Cervix of the Scapula, near the Basis of the coracoïd Apophysis.

The two musculous Portions, thus separately fixed by their superior Tendons, approach gradually as they descend, and, before they reach the Middle of the Humerus, are closely united, forming, afterwards, a common Tendon of a considerable Breadth, which is inserted laterally into the posterior Margin of the Tuberosity at the Cervix of the Radius.

This inferior or common Tendon of the Biceps, a little before its Insertion, sends off towards the internal Condyle an Aponeurosis*, which, increasing obliquely in Breadth on the same Side, covers the internal and posterior Parts of almost the whole Fore-Arm, especially the Muscles which lie upon the Ulna, where it is insensibly lost: It likewise adheres strongly to the Muscles named Pronator Teres and Radialis Internus, on the anterior Side of the Articulation of the Elbow.

Both the musculous Portions of the Biceps contribute to the Formation of this Aponeurosis, each of the two Portions of which the common Tendon is composed, furnishing a Series of tendinous Fibres, which, covering the anterior Side of the true Tendon, unite near the internal Condyle by a particular kind of Intertexture, and thus produce the Aponeurosis.

2. BRACHIÆUS INTERNUS is an oblong, thick, and broad Muscle, lying immediately on the anterior Part of the inferior Half of the Humerus: The superior Part of it is bifurcated, and, at the Flexure of the Articulation of the Elbow, the inferior Part contracts.

It is fixed to the Surface of the Humerus by a great Number of musculous Fibres, from the in-

* It is an Error to think, as some Anatomists do, that when, in Venesection, this Aponeurosis is wounded, it causes the Arm to swell; but it certainly is when some of the Branches of the cutaneous Nerves are wounded which ramify on this tendinous Membrane.

ferior Insertion of the *Deltoides* almost down to the two *Fossæ* at the inferior Extremity of the Bone, and from one anterior Margin of this inferior Extremity to the other. The Fibres are partly longitudinal; those nearest the Surface of the Muscle being longest, and the more internal growing gradually shorter.

The lateral Fibres are a little oblique, and this Obliquity increases in those that lie lowest: These lateral Fibres are partly fixed in the intermuscular Ligaments of the Humerus, of which, that lying towards the internal Condyle is longer and broader than that towards the external Condyle; the lowest of these Fibres are very oblique, and form, on each Side, a kind of small separate Fasciculus.

In passing over the Articulation all these Fibres contract in Breadth, and terminate in a strong flat Tendon inserted into the muscular Impression that is directly below the coronoid Apophysis of the Ulna: This Muscle adheres very strongly to the capsular Ligament, and some of its muscular Fibres terminate therein.

The bifurcated superior Extremity of this Muscle embraces the large Tendon of the *Deltoides*; the internal Apex of the Bifurcation meets the inferior Insertion of the *Coraco-Brachialis*, and anteriorly the whole Muscle is covered by the two muscular Portions of the *Biceps*.

3. *ANCONÆUS MAJOR*, a long Muscle lying posteriorly on the Humerus, is fixed superiorly, by a short Tendon, to the inferior Impression in the Cervix of the Scapula, and to a small Part of the inferior Costa of that Bone; thence it passes between the Extremities of the *Subscapularis* and *Teres Minor*, and, having reached the posterior Side of the inferior Extremity of the Humerus, it terminates obliquely in a strong broad Tendon; which, adhering closely to the capsular Ligament,

ment, is afterwards fixed, by a broad Insertion, in the rough Tuberosity superiorly on the Olecranium.

It lies between the two lateral Anconæi, and, by its Adhesions to them, a triceps is formed, of which this is the middle Portion. We call these three Muscles Anconæi, from their Insertions into the Olecranium or Ancon.

4. ANCONÆUS EXTERNUS is a long Muscle lying externally on the posterior Side of the Humerus, from its Cervix to the external Condyle: It is fixed superiorly in the Cervix of the Humerus under the inferior Surface of the great Tuberosity and that of the Insertion of the Teres Minor, but a little posteriorly; and descends by the Anconæus Major, adhering strongly to the Humerus, except at that oblique Depression, on account of which, this Bone appears contorted: It is likewise fixed, by some oblique Fibres, in the external inter-muscular Ligament.

From all this Space the musculous Fibres contract in Breadth, being connected, more or less obliquely, to the external Margin of the Tendon of the Anconæus Major all the Way to the Olecranium. The Termination of these two Muscles in the common Tendon, forms a very acute Angle, and represents a Sort of penniform Muscle.

5. ANCONÆUS INTERNUS is shorter, and more musculous, than the Anconæus Externus, and lies about Half the interior and inferior Portion of the Humerus; is fixed superiorly under the inferior Extremity of the Teres Major, but a little more posteriorly; and to the internal inter-muscular Ligament which makes a kind of Septum between this Muscle and the Brachæus: Thence the Fibres, contracting in Breadth, pass towards the Tendon of the Anconæus Major, some of them running in between it and the Bone, and are

inserted into the Margin and internal Side of that Tendon.

6. ANCONÆUS MINOR is a small Muscle, obliquely triangular, lying in the oblong Fossula exteriorly on the Olecranon; and is fixed, by a small but pretty strong Tendon, in the inferior Part of the external Condyle of the Humerus: Thence the musculous Fibres descend obliquely in a radiated Form, and are inserted into the Basis and whole posterior Margin of the Fossula already mentioned.

It is closely united to, and in some Subjects seems to communicate by several Fibres with, the Muscle termed Ulnaris Externus; and its Tendon adheres very strongly to that of the Anconæus Externus*.

These Muscles move not only the Fore-Arm on the Humerus, but also the Humerus on the Fore-Arm: Neither are they all confined to these two Motions alone; for the Biceps or Coraco-Radialis and Anconæus Major may move the Humerus on the Scapula, and the Scapula on the Humerus. The Biceps, by its Insertion into the Radius, performs, likewise, the Motion of Supination, and that with much more Force than the Muscles commonly assigned for that Action by the Name of SUPINATOIRES.

The Motions of the Fore-Arm on the Humerus are not all performed by these six Muscles alone. The SUPINATOR LONGUS, as it is named, assist therein, as has been observed by HEISTER; and indeed it seems better fitted for that Motion than Supination, as we shall demonstrate; and, for

* Some Anatomists have confounded this Muscle with the Ulnaris Externus, by raising them together; looking afterwards, in vain, for the Anconæus Minor; which, however, is very easily distinguished from the other by a fatty or cellulous Line.

that Reason, it is ranked among the auxiliary Muscles which move the Fore-Arm on the Humerus, &c. by the Name of *RADIALIS LONGUS*.

USES OF THESE MUSCLES.

The Biceps moves the Fore-Arm in two different Manners; that is, it bends both Bones, and turns the Radius upon the Ulna; performing both Motions by its Insertions into the Radius alone. It likewise moves the Humerus on the Fore-Arm; the Scapula on the Humerus, and the Humerus on the Scapula.

These five Uses belong to this Muscle, though it is commonly limited to that of flexing the Fore-Arm; and to these we may add a sixth, by means of the Passage of one of its superior Tendons over the Articulation of the Humerus with the Scapula through a ligamentary Vagina, which serves as a Frænum, and may be looked upon as an annular Ligament produced.

When it bends the Fore-Arm upon the Humerus, the Scapula must be kept steady by the Muscles which move it on the Trunk; and, in this Function, it is a Congener or Assistant to the Brachialis, which is inserted into the Ulna: And when the Brachialis becomes incapable of acting, by a Wound, or any other Disease; the Biceps, alone, may perform the Flexion of the Fore-Arm by being inserted into the Radius, and by the Connexion of that Bone with the Ulna*.

* To be satisfied that it turns the Radius, and performs the Motion called Supination, we need only consider the Manner of its Insertion into the Tuberosity of the Radius, already described, and then look on a Skeleton; and even without these Assistances, the following Experiment will prove it.

If, when the Fore-Arm is moderately bent, and in a pronated Situation, we perform the Motion of Supination with one Hand, and lay the other on the Biceps at the same Time; we shall perceive it to swell, and grow hard, in Proportion as the Supination advances. This Muscle is therefore a true Supinator.

The third Use of the Biceps, which is to move the Humerus on the Fore-Arm, cannot take Place till the Fore-Arm is fixed by some exterior Force; as when we hold the Branch of a Tree with the Hands, the Arm being extended, and afterwards bend the Arm, in order to climb. In this Case, Part of the Flexion is performed by the Motion of the Humerus on the Fore-Arm. And though this whole Action is not owing to the Biceps, yet it as really contributes to it as the Brachialis.

The fourth Use of the Biceps is, to move the Scapula on the Humerus. In order to this, the whole Arm must be kept fixed, much in the same Manner as was mentioned in describing a like Use of the Coraco-Brachialis; whether this be done by any exterior Resistance applied to the Fore-Arm or Hand, or by pressing the Hands strongly against each other behind the inferior Part of the Back. In these Cases, the Contraction of the Muscles will draw down the Acromia, and bring the Bases of the Scapulæ nearer each other.

The fifth Use of this Muscle is, to move the Humerus on the Scapula by raising it; much in the same Manner as is done by the Coraco-Brachialis. The Manner in which this is performed is easily conceived; as also that it is done, most readily, when the Fore-Arm is extended.

The particular Use of the Tendon which passes through the ligamentary Vagina over the Articulation of the Scapula with the Humerus is, to cooperate with the Tendon of the Supra Spinatus in
hin-

hindering the Head of the Humerus from getting out of the glenoid Cavity in the first Efforts of the Deltoïdes to raise the Arm.

Though this Tendon of the Biceps be very small, and passes over a very smooth convex Surface; yet it cannot slip to either Side, because of the thick Vagina that lies between the two Tuberosities of the Head of the Humerus, and there chiefly confines it. Besides, in Proportion as the Arm is raised, that Part of the Tendon which passes over the Articulation becomes gradually shorter, because the Frænum approaches, by the same Degrees, to the Place where it is inserted.

The Brachialis serves to bend the Fore-Arm on the Humerus by its Insertion into the Ulna, and by the Connexion of that Bone with the Radius. It serves, also, to move the Humerus on the Fore-Arm. The small lateral Portions of the inferior Extremity of the fleshy Part of this Muscle, and the Fibres between these Portions nearest the Bone, are very short, and seem to make a distinct Muscle, which does not reach to the Ulna, but is inserted into the capsular Ligament of the Articulation of the Elbow.

These Insertions into the Ligament are very apparent in many Subjects, and their Use seems to be much the same with what is ascribed to the like Fibres in the Supra Spinatus; that is, to prevent the Ligament from being caught and squeezed between the Bones, in great Flexions of the Arm.

The Anconæus Major serves to extend the Fore-Arm, by bringing the Ulna to a strait Line with the Humerus: It serves, likewise, to extend the Humerus on the Ulna when this Bone is fixed, by some exterior Resistance; as when, being laid upon the Ground, we rise by supporting ourselves on the Hand. In this Case, likewise, the Scapula

pula must be kept steady by the Coraco-Brachialis. It may likewise move the Scapula on the Humerus by its Insertion into the Cervix of the first of these Bones, by means of which it may draw the Basis downwards, and raise the Top of the Shoulder.

By its Insertion into the Scapula it may likewise draw the Arm backwards in a more direct Line than can be done by the Teres Major and Minor.

The two lateral Anconæi co-operate with, and assist the Anconæus Major, in extending the Fore-Arm on the Humerus, and the Humerus on the Fore-Arm.

The Anconæus Minor may concur with the other Muscles of that Name, in extending the Fore-Arm on the Humerus and the Humerus on the Fore-Arm; but its Action does not reach to all the Degrees of Flexion of these Bones: For, when the Fore-Arm is very much bent, if we examine carefully the Situation of this Muscle, we shall find it more disposed to maintain these Bones in that Posture, by co-operating with the Brachialis, than to extend them by assisting the other Anconæi.

MUSCLES WHICH MOVE THE RADIUS UPON THE ULNA.

These Muscles are reckoned to be four in Number; viz.

1. SUPINATOR LONGUS, or MAJOR, is a long flat Muscle lying on the external Condyle of the Humerus, and on the convex Side of the Radius from one Extremity to the other: It is fixed, by musculous Fibres, to the external inter-muscular Ligament, and to the Crista of the external Condyle of the Humerus, for five or six
Fingers
Breadth

Breadth above the Condyle, between the Brachiæus and Anconæus Externus; from thence it runs along the whole convex Side of the Radius, and is inserted by a flat narrow Tendon, a little above the styloïd Apophysis, into the Angle between the concave and flat Sides of the Extremity of this Bone.

2. SUPINATOR BREVIS, or MINOR, is a small, thin, fleshy Muscle, surrounding a great Portion of the superior third Part of the Radius: It is fixed, by one Extremity, to the inferior Part of the external Condyle of the Humerus; to the external lateral articular Ligament, the annular Ligament of the Radius, and to Part of the lateral Eminence in the Head of the Ulna: Thence it passes obliquely over the Head of the Radius, covering some Part of it, and descending upon, and in some measure surrounding the Cervix, it turns in under the bicipital Tuberosity, and is inserted, by the Side of the interosseous Ligament, into the internal Side of the superior Quarter of the Bone, and even a little lower.

In some Subjects we may observe the Marks of the Passage of this Muscle over the external Side of the Bone. It makes an Angle with the Pronator Teres resembling the Roman V.

3. PRONATOR TERES, or OBLIQUUS, is a small Muscle, broader than it is thick, situated on the superior Part of the Ulna opposite to the Supinator Brevis, with which it forms an Angle like the Letter V. It is fixed to the internal Condyle of the Humerus, partly by musculous Fibres, and partly by a Tendon common to it, with the Ulnaris Internus; thence it passes obliquely before the Extremity of the Tendon of the Brachiæus, and reaches to the middle Part of the convex Side of the Radius, where it becomes flat, and is inserted, below the Supinator Brevis, by an

Extremity almost musculous. The Name of PRONATOR SUPERIOR, or OBLIQUUS, would be the most proper.

4. PRONATOR QUADRATUS, or TRANSVERSUS, is a small fleshy Muscle, nearly as broad as it is long, lying transversely on the internal Side of the inferior Extremity of the Fore-Arm: It is fixed, by one Side or Margin, in the long Eminence at the inferior Part of the internal Angle of the Ulna, and by the other in the broad concave Side of the inferior Extremity of the Radius.

It is wholly musculous, without any Mixture of tendinous Fibres; is situated transversely, but that Extremity which lies on the Radius is nearer the Carpus than that on the Ulna; is of a moderate Thickness, and the Fibres nearest the Surface are the longest, the rest decreasing in Proportion as they lie near the Interval between the two Bones and the interosseous Ligament.

It has a ligamentary or tendinous Frænum belonging to it, one Extremity of which is fixed in the interosseous Ligament, the other in the internal Margin of the Basis of the Radius.

USES OF THESE MUSCLES.

The Supinator Longus was thought to be concerned only in the Motion of Supination, till HEISTER very justly observed, that it was likewise a Flexor of the Fore-Arm. And, indeed, a very small Degree of Attention to its Insertions and Situation must convince us, that it is much better fitted for this last Use, than for the first. For, before it can act as a Supinator, the Hand must be in the greatest Degree of Pronation; and, even then, it can do little more than bring the Radius back to its natural Situation without completing the Supination, except it be by Jerks. It would

therefore be much more properly named *RADIALIS LONGUS*, than *SUPINATOR LONGUS*.

This Muscle may bend the Fore-Arm by means of the Connexion of the Radius with the Ulna in several different Situations; that is, when the Fore-Arm is fully extended, the Radius being either in a Motion of Pronation or Supination, or in a middle Situation between both.

On this Occasion it is proper to observe, that the Method of examining the Uses of the Muscles, on dead Bodies, by pulling them, in order to move the Bones, into which they are inserted, is very uncertain; except particular Care be taken to pull them in their true natural Direction, which is often different from what it appears to be when they are dissected, by reason of the lateral Connexions, *Fræna*, &c.

Supination, performed when the Fore-Arm is fully extended, is commonly attributed, in Part, to the Rotation of the Humerus, by means of its Articulation with the Scapula; as if this Supination, when the Arm is extended, were greater than when it was bent: Whereas the Difference, in Supination, is really but very small; though it be very considerable in the Motions of Pronation, as we shall observe.

The *Supinator Brevis* seems to have no other Use than what its Name expresses; and as it is a small short Muscle, it must be very weak.

Its Use is chiefly owing to the Obliquity of its Fibres; but still neither this, nor the former Muscle, would be able to perform Supination, where a great Force is required, without the Assistance of the *Biceps*; which is the most powerful of all the *Supinators*, and the chief Actor in this Motion, as we have already proved.

The *Pronator Teres* can have no other Action but that of Pronation, in the different Situations
of

of the Radius, whether that Bone be in a middle State between Pronation and Supination, or in the greatest Degree of Supination : And, in this Case, though it is but a small weak Muscle, it overcomes the Supinator Longus.

The Pronator Quadratus is capable of no other Motion but Pronation ; and it acts with much more Force than its Congener the Pronator Teres ; both because of the Number and Direction of its Fibres, and because it acts upon the Radius near the inferior Extremity, where its Effects in Pronation are much greater than if it acted near the Head of that Bone. The Fibres lie almost in the same Direction in which the Bone moves ; and in this it has the Advantage not only over the other Pronator, but over all the Supinators, the Biceps itself not excepted.

The Fibres, of which this Muscle is composed, are so disposed, as that the longest adhere to the internal Angles of both Bones of the Fore-Arm. The shortest lie nearest the interosseous Ligament, and the intermediate Fibres are longer or shorter, according to their greater or lesser Distance from the Ligament.

By these different Degrees of Length, the whole Number of Fibres is advantageously disposed, and their Action rendered uniform. In the greatest Degree of Supination the Extremity of these Fibres, inserted into the two Bones, make a very oblique Plane, which becomes almost strait, in the greatest Degree of Pronation. We shall have other Examples of this kind of Mechanism, and it shall then be explained, and accounted for.

The Motions of Pronation and Supination are commonly attributed to the Radius alone ; and the Ulna is believed to have no other Share therein than to serve as a Fulcrum, or Basis, on which these reciprocal Turns or Rotations of the

Radius are made. And; lastly, these Motions are said to be the Effects of four Muscles, or, at most, of five, the Biceps being included.

Anatomists likewise pretend, that they have seen others demonstrate, that they have demonstrated themselves, and that they are able at any Time to demonstrate, both on the Skeleton, and fresh Subjects, these two reciprocal Motions, without any Motion in the Ulna: And they have even gone so far, both in public and private, as to make Experiments on their own Arms, to prove that the Radius, alone, performs these Motions; and that the Ulna has no Share in them.

All this, notwithstanding, has been observed and demonstrated to the ROYAL ACADEMY OF SCIENCES, that in these Motions, when free and unconstrained, the two Bones of the Fore-Arm move always at the same Time.

Thus, for instance, when we turn the Radius towards the Thorax, in Pronation, the Ulna is, at the same Time, turned from the Thorax; and, when we turn the Radius from the Thorax, in Supination, the Ulna is, at the same Time, brought nearer to it; supposing, in both these Motions, that the Fore-Arm is bent.

In these Motions the Radius rolls simply from one Side to the other; its Extremity, in a complete Pronation or Supination, describing a kind of Semicircle; and, at the same Time, the Extremity of the Ulna, moving in a contrary Direction, describes another Semicircle.

Thus, in Pronation, we raise the Extremity of the Ulna, and remove it from the Thorax at the same Time; and, in Supination, we first depress it, and then raise it again, as it is brought nearer to the Thorax.

Neither

Neither is this all: For these small Motions of raising and lowering, Adduction and Abduction, in the Extremity of the Ulna, cannot be brought about without the Rotation of the Humerus, because of the Ginglymus, by which these two Bones are articulated. Therefore, in all unconstrained Pronations and Supinations, three Bones must move, and all the Muscles concerned in these Motions must act; and, likewise, during this Action, the Scapula must be kept fixed.





LECTURE XIII.

Of the Muscles which move the CARPUS upon the FORE-ARM, the Bones of the METACARPUS, and those of the FINGERS.

THE Muscles which immediately perform the Motions of the CARPUS on the FORE-ARM, are six in Number. They have the Names of ULNARIS and RADIALIS from their Situation, being all situated along the ULNA and RADIUS*.

I. ULNARIS INTERNUS is a long Muscle, muscular at its superior Extremity, and tendinous at the other, situated externally on the Ulna: It is fixed, by its superior Part, in the posterior Side of the long or internal Condyle of the Humerus, in that Part of the Olecranon which is next the Condyle, along the superior Half of the Ulna, very nearly; and to the middle common Tendon of the circumjacent Muscle, commonly called PROFUNDUS.

* The auxiliary Muscles which assist in moving the CARPUS on the FORE-ARM, belong to the Class of those that move the FINGERS, as we shall see hereafter.

It runs in the Direction of the external Angle of the Ulna, and terminates, by a long Tendon, in the Os Pisiforme or Orbiculare of the Carpus, reaching likewise to the Os Unciforme, being united to the Ligament common to these two Bones.

2. *RADIALIS INTERNUS* is a long Muscle, very much like the foregoing, but situated more obliquely: Its musculous Portion is fixed, by a short Tendon, to the external and superior Side of the internal Condyle of the Humerus; thence it passes obliquely towards the Radius, and, running along about two Thirds of that Bone, it forms a long Tendon which continues in the same Course, and, at the inferior Extremity of the Radius, passes under a particular annular Ligament, and under the Insertion of the *Musculus Thenar*.

This Tendon is, at length, inserted chiefly in the internal Side of the Basis of the first metacarpal Bone, and often in the second likewise, and a little in the first Phalanx of the Thumb, having first passed through the Sinus of the Os Trapezium, which sustains the Thumb.

3. *ULNARIS EXTERNUS* is a long Muscle lying externally on the Fore-Arm, musculous towards the Humerus, and tendinous towards the Carpus: It is fixed superiorly to the external Condyle of the Humerus, being there connected to the *Anconæus Minor*, the annular Ligament of the Head of the Radius, and the superior Half of the external Angle of the Ulna; thence it advances, and forms a Tendon which passes through the external Fissure at the inferior Extremity of this Bone, on one Side of the styloid Apophysis.

The Tendon, having afterwards passed under a particular Ligament situated near the Os Cuneiforme of the Carpus, is inserted into the external Side of the Basis of the fourth metacarpal Bone,

sending some tendinous Filaments to the Basis of the Little Finger: It is likewise often fixed in the Basis of the third metacarpal Bone.

4. **RADIALIS EXTERNUS PRIMUS** and **SECUNDUS** are two Muscles closely connected, appearing, at first Sight, like one Muscle lying along the external Angle of the Radius, between the Humerus and the Carpus, being musculous near the former, and tendinous near the latter.

In many Subjects we find these two Muscles entirely distinct from one Extremity to the other; and they may be named **RADIALIS EXTERNUS PRIMUS** and **RADIALIS EXTERNUS SECUNDUS**, Regard being had to the Insertion of their Tendons. Sometimes the two musculous Portions adhere closely, appearing to make but one Body; but the Tendons are always distinct and separate.

The first is inserted, superiorly, into the Crista of the external Condyle of the Humerus, below the Insertion of the *Supinator Longus*; the second in the same Condyle, below the Insertion of the first, and in the adjacent articular Ligament; thence the two musculous Portions descend very close together, and, having reached the Middle of the external Part of the Radius, each of them terminates in a long Tendon.

The two Tendons accompany each other to the Extremity of the Radius, and, having passed under a particular annular Ligament, they are divided, as it were, into two Cornua; whence the Antients, who looked upon them as one Muscle, named it **BICORNIS**.

One of these Tendons is inserted anteriorly into the Basis of the first metacarpal Bone, the other nearly in the same Place of the second Bone, which is the Reason why we chose to distinguish them by the Names of **PRIMUS** and **SECUNDUS**. The Tendon

Tendon of the first is sometimes double, appearing like another Bicornis.

5. ULNARIS GRACILIS, commonly called PALMARIS LONGUS, is a small Muscle lying between the Humerus and the Carpus on the internal Side of the Fore-Arm, its Body being small and slender, its Tendon very long and flat: It is fixed, by its musculous Portion, in the small Crista of the internal Condyle of the Humerus; sometimes closely connected to the Ulnaris Internus; thence it runs down fleshy for some Space, turning a little obliquely towards the Middle of the Fore-Arm, and terminates in a long, narrow, thin Tendon.

This Tendon passes down the Middle of the Fore-Arm, over all the other Muscles to which it slightly adheres, and, advancing over the large internal annular or transverse Ligament of the Carpus; is inserted into the Surface thereof, sending off some radiated Filaments to the Aponeurosis Palmaris*.

6. PALMARIS CUTANEUS, commonly known by the Name of PALMARIS BREVIS, is a small thin Plane of musculous Fibres situated transversely or more or less obliquely under the Skin of the large Eminence in the Palm of the Hand, between the Carpus and Little Finger; its Fibres adhering to the Skin, and being, in some measure, interwoven with the Membrana Adiposa.

* I have found this Muscle fixed to the Condyle of the Humerus by a Tendon about a Finger's Breadth in Length, to which the musculous Portion was connected towards the Middle of the Fore-Arm. I have likewise seen the inferior Tendon inserted into the Os Scaphoides of the Carpus, without communicating with the large annular Ligament; and the Aponeurosis Palmaris arise from this Ligament: From all which it may reasonably be concluded, that that Aponeurosis has no essential Dependence on this Muscle.

Sometimes it appears to be only a Production from the Ulnaris Internus; WINSLOW.

These Fibres are fixed along the Margin of the Aponeurosis Palmaris from the large Ligament of the Carpus towards the Little Finger; and they run in, for some Space, on the Plane of the Aponeurosis, but without any Connexion with the Bones of the Metacarpus: Near the Aponeurosis these Fibres are more or less tendinous, and some of them often cross each other: They are sometimes so thin and pale, as hardly to be sensible; and in some Subjects this Muscle seems to be divided into several Portions.

These Muscles may likewise move the Fore-Arm on the Carpus, and in some Cases they cannot, without Assistance, perform the Motions attributed to them.

USES OF THESE MUSCLES.

The Motion of the CARPUS is made, principally, on the Extremity of the Radius, and on the Ulna, only by the Intervention of the inter-articular Cartilage, or cartilaginous Production of the Radius. We are not to have Regard only to the Carpus in general, in these Motions, because some of them relate also to the Metacarpus, and others to particular Bones of the Carpus. The Motions of the Carpus likewise affect the whole Hand, which is thereby carried different Ways, and put in different Situations.

The chief Motions of the Carpus are expressed by Terms not altogether proper, but which may be retained, as having been long in Use, provided they are well explained to those who are not accustomed to them.

Turning the Hand towards the internal Side of the two Bones of the Fore-Arm, is called bending the Wrist; and the Wrist is said to be extended, when the Hand is turned towards the external Side
of

of the Fore-Arm. When it is turned towards the Radius alone, that Motion is called Adduction, with regard to the Humerus; and Adduction, in the same Sense, is when the Hand is turned towards the Ulna alone.

These Motions are attributed to four Muscles; the Ulnaris Internus, Radialis Internus, Ulnaris Externus, and Radialis Externus, or Bicornis.

Flexion is performed by the two internal Muscles; Extension by the two external: Abduction by the two Ulnares, and Adduction by the two Radiales.

These Muscles may likewise successively perform several subaltern or oblique Motions of the Carpus and Hand, by the Combination of two principal or direct Motions. Thus the Radius being fixed, in its natural Situation, between Pronation and Supination, we may, by a Motion of Flexion and Abduction together, turn the Hand obliquely, and, at the same Time, partly towards the Fold of the Arm, and partly towards the external Condyle.

These combined Motions cannot, however, be performed with near so much Freedom as the simple Motions of Flexion, &c. because of the oblong Figure of the Joint of the Wrist; and the Ease and Readiness with which they seem to be performed, is owing to the Assistance of the Motions of Supination and Pronation.

When the Ulnaris Internus acts alone, or as the principal Mover, it brings the Hand obliquely towards the internal Condyle and Olecranon, though with Difficulty, for the Reason already given; when it acts together with the Radialis Internus, it turns the Hand equally towards the two Extremities of the Bones of the Fore-Arm, and thereby moves not only the Carpus in general on the Fore-Arm, but also the second

Row of the Carpus on the first, and the metacarpal Bones on the second. When it acts with the Ulnaris Externus, it turns the exterior Margin of the Hand towards the Olecranium, as already said. With the Radiales Externi it turns the Back of the Hand towards the exterior Condyle: This Motion is named Extension, but very improperly, when applied to the Hand. For the Metacarpus, which is naturally bent this Way, will be still more bent by the Action of these Muscles. We choose, therefore, to call this Motion the Inversion, rather than the Extension, of the Hand. The Carpus indeed may, in some measure, be said to be extended, because the Bones of the second Row are brought to a straiter Line with those of the first.

When this Muscle acts alone, it brings the exterior Margin of the Hand obliquely towards the Olecranium and the external Condyle at the same Time; but this is performed with Difficulty, as has been already observed.

The Radialis Internus, together with the Ulnaris Internus, has the Uses already mentioned. With the Radialis Externus it carries the interior Margin of the Hand, or that next the Thumb, towards the Extremity of the Radius, and towards the Fold made by the Ulna and Humerus. Alone it moves that Part of the Hand which is next the Thumb obliquely towards the internal Angle of the Radius, but with the same Difficulty as the rest when they act singly. It seems likewise to deserve the Name of a third Pronator.

What first gave the Notion of this Use was, the Consideration of the Obliquity of its Direction between its two Insertions, which is greater, in Proportion, than that of the Supinator Longus; which, therefore, must be less fitted for Supination than the other is for Pronation. The an-
nular

nular Ligament through which the Tendon of the Radialis Internus passes, is looked upon as a Sort of Insertion, with respect to the Direction of the Muscle; and we plainly perceive the Tendon to be stretched, in a strong Motion of Pronation.

The Radialis Externus, together with the Radialis Internus, turns the interior Margin of the Hand directly towards the styloid Apophysis of the Radius. With the Ulnaris Externus it inverts the Hand, turning the convex Side of the Metacarpus towards the inferior Extremity of the Bones of the Fore-Arm: It likewise moves the second Row of the Carpus on the first, and thereby increases the transverse Fold; on the convex Side of the Carpus, mentioned in the general Observations on the Situation of the Bones in the superior Extremity. This Motion likewise increases the Angle which the Back of the Hand naturally makes with the external Side of the Fore-Arm; and therefore, according to the common Language, it would be more properly named an external Flexion, than an Extension.

This Muscle, acting alone, draws obliquely, and towards the external Angle of the Radius, that Portion of the Hand which answers to the first metacarpal Bone, and to the Index; but this is done with the same Difficulty that has been already taken Notice of in the other Muscles.

Each of the two Radiales Externi may act separately, and, consequently, have distinct Uses; since their Tendons, having passed the annular Ligament, are inserted at some Distance from each other; and thereby one of them seems to be fitted to co-operate with the Radialis Internus, the other with the Ulnaris Externus; and they both serve, conjointly, to keep the Hand in its true natural Situation mentioned before.

The Ulnaris Gracilis, commonly called Palmaris Longus, seems to be an Assistant to the Ulnaris and Radialis Interni in bending the Wrist; and it seems likewise particularly to assist the Radialis Internus in the Motion of Pronation.

These Muscles cannot move the Radius on the Ulna without moving it, at the same Time, on the Humerus; but the Radius may be moved on the Humerus without being moved on the Ulna; and, consequently, without the Assistance of the Muscles commonly assigned to the Radius.

We have already observed, that the Supinator Longus does not belong more particularly to the Radius than to the Ulna; and that it is much better fitted for bending the Fore-Arm, than for the Supination of the Radius, as shall be farther shewn in describing the Uses of the Muscles.

There are some Cases in which these Muscles cannot perform the Motions, either of Supination or Pronation, without the Assistance of those that move the Fore-Arm on the Humerus, and even of some that move the Humerus on the Scapula.

MUSCLES WHICH MOVE THE BONES OF THE METACARPUS.

There is one Muscle which very visibly moves the fourth metacarpal Bone on the Os Unciforme of the Carpus, and thereby draws the third metacarpal Bone along with it: This Muscle, which may be called METACARPIUS, has been always hitherto looked upon as a Portion of a Muscle belonging to the Little Finger.

The metacarpal Bones are likewise moved on the Carpus by the Ulnares and Radiales, and by all the Muscles in general which go to the Fingers, as by so many Auxiliaries.

The Number of metacarpal Muscles would be increased, if the first Phalanx of the Thumb was looked upon as a metacarpal Bone.

METACARPIUS is small, but very musculous, situated obliquely between the large internal annular or transverse Ligament of the Carpus and the whole internal Side of the fourth metacarpal Bone: It is fixed, by a small short Tendon, to the Os Orbiculare, and to the circumjacent Part of the large carpal Ligament; thence its Fibres run, more or less obliquely, towards the internal Side of the fourth metacarpal Bone, into the external Margin of which they are inserted. The Fibres of this Muscle are of unequal Lengths, and extend all the Way to the Articulation of the first Phalanx of the Little Finger with the fourth metacarpal Bone, but they have no Relation to that Finger.

THE USE OF THE METACARPIUS

Is to turn the fourth Bone of the Metacarpus towards the Thumb, and, at the same Time, to increase the Convexity of the Back of the Hand, which is called making *DIAGENES's* Cup. The fourth Bone, thus moved, carries the third along with it, by reason of their Connexion; which still augments the Hollow on one Side, and the Convexity on the other.

MUSCLES WHICH MOVE THE FINGERS.

These may be divided into those which move the Thumb, and those which move the other four Fingers: Both these may again be divided into large or long, and small or short Muscles. The Distinction of these Muscles into common and proper is not suitable, because these two Terms are afterwards used as the proper Names of
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of some particular Muscles which move the four Fingers*.

1. FLEXOR POLLICIS LONGUS is a long Muscle, fixed, by short and oblique musculous Fibres, to the internal Side of the superior Part of the interosseous Ligament near the Radius, and along that Bone all the Way down to the Pronator Quadratus: There it terminates in a flat Tendon, which is insensibly formed from the very Beginning of its superior Insertion, by all the musculous Fibres of which the Muscle is composed.

This Tendon, having passed under a particular Ligament, runs in between the two Portions of the Thenar, and then into a sort of Sinus left between the two sesamoïd Bones fixed to the Basis of the second Phalanx of the Thumb, on that Side which is turned to the Palm of the Hand; afterwards, the Tendon terminates in the flat Side of the third Phalanx, near its Basis. It is inclosed in a ligamentary Vagina from the annular Ligament to its Insertion, and is divided, or slit, so that it appears to be inserted by two Extremities adhering by their Margins.

2. EXTENSORES POLLICIS are two very distinct Muscles, the first or longest of which is sometimes more, sometimes less, and sometimes altogether, divided into two; in which Case, these Muscles are three in Number. They are situated obliquely between the Ulna and convex Side of the Thumb.

* I said, at the Beginning of this Treatise, that, for Muscles solely fixed in Bones, I would make Use of no Names taken from the Functions attributed to them: However, as the greatest Part of the Muscles of the Fingers and Toes have proper Names, and only a few of them are called Flexors, or Extensors; these Names may still be retained, provided they are looked upon only as proper Names.

The *EXTENSOR PRIMUS* is a long Muscle, more or less double, in the Manner already said: It is fixed above, by musculous Fibres; first, externally to the Ulna near its superior Extremity, below the *Anconæus Minor* and Insertion of the *Ulnaris Externus*; next, to the inter-ossæous Ligament under the *Supinator Brevis*; and, lastly, to the middle external Part of the Radius.

Thence it descends, and passes anteriorly over the inferior Part of the Radius and Tendons of the *Supinator Longus* and *Radialis Externus*; and, being gradually divided, it terminates in two long flat Tendons, more or less subdivided, which pass together under a particular annular Ligament, being separated only by *Septa* or *Fræna* belonging to that Ligament.

The first of these two principal Tendons is inserted into the Margin of the Basis of the first Phalanx, near the large transverse Ligament of the Carpus. When this Tendon is subdivided, the other Portion of it is fixed in that Bone of the Carpus which sustains the Thumb; the other principal Tendon, which often belongs to a Muscle entirely distinct from the former, is fixed in the convex Side of the Basis of the second Phalanx, where it joins the Tendon of the *Extensor Secundus*. On account of these different Insertions of the two Tendons, this Muscle is, by some Authors, described as two.

The *EXTENSOR SECUNDUS* is shorter than the first: It is fixed to the Ulna below the former, and above the Insertion of the *Extensor Indicis Proprius*, and likewise to the adjacent Part of the inter-ossæous Ligament; thence it descends obliquely on the middle Part of the Radius, where it has likewise a small Adhesion; afterwards it passes through the small Sinus in the styloid Apophysis of the Radius, through the annular Ligament be-

longing to the Tendons of the Radialis Externus, and over these Tendons, being separated from them by a small ligamentary Septum. It is inserted into the convex Part of the third Phalanx near its Basis, having, as it passes over the second Phalanx, joined the second or collateral Tendon of the first Extensor, more or less.

3. THENAR is very thick, musculous, and, in some measure, pyriform, lying on the first Phalanx of the Thumb towards the Palm of the Hand, the large Eminence in which is chiefly formed by it. Its Name signifies to strike; as Schoolmasters strike their Scholars on the Hand, I suppose.

It is fixed to the Bone which supports the Thumb, and to the adjacent Part of the great internal annular or transverse Ligament of the Carpus; and is, in some measure, bicipital, two distinct Portions answering to the two Insertions already mentioned. As it runs along the first Phalanx these two Portions unite, and, diminishing in Thickness, are both inserted, by one Tendon, into the lateral internal Part of the Head of the first Phalanx, in the lateral Part of the Basis of the second, and in the lateral Ligament of that Articulation.

The void Space between the two Portions of this Muscle gives Passage to the Tendon of the Flexor Pollicis Longus; that Portion which lies nearest the Cavity of the Hand is the largest, and its tendinous Extremity is inserted into the first sesamoid Bone situated at the Basis of the second Phalanx.

4. MËSO-THENAR is a flat and nearly triangular Muscle lying between the first Phalanx of the Thumb and the Basis of the Palm of the Hand, and is inserted, by a very broad Basis, into the Ligament which connects the Os Magnum of the Carpus to that which supports the Thumb; is likewise

likewise inserted along the internal or angular Part of that Bone of the Metacarpus which supports the Middle Finger, and in the small Extremity of that which answers to the Index: Thence the Fibres, contracting to an Angle, terminate in a flat Tendon, of different Breadths, which is inserted into that Side of the Head of the first Phalanx of the Thumb which is turned to the Cavity of the Hand, and into the adjacent Part of the Basis of the second Phalanx, by means of the second sesamoid Bone belonging to that Articulation.

5. ANTI-THENAR, or SEMI-INTEROSSEUS POLICIS, is small, flat, but musculous, situated obliquely between the first Phalanx of the Thumb and first metacarpal Bone; and is fixed by one Extremity towards the Basis of the first metacarpal Bone, near the first Bone of the second Row of the Carpus: Thence it runs obliquely towards the Head of the first Phalanx of the Thumb, and is inserted into the lateral external Part of that Bone, or on that Side which is turned to the first metacarpal Bone. It crosses the Semi-interosseus Indicis, this Muscle lying towards the Back of the Hand, and the Anti-thenar towards the Palm.

6. PERFORATUS, or SUBLIMIS, is of a considerable Volume lying along the internal Side of the Fore-Arm, musculous, for the greatest Part, near the Articulation of the Fore-Arm with the Humerus, and near the Carpus terminating in four distinct Portions, which become the same Number of long small Tendons. The Name of Sublimis has been given to it because it lies almost on the Surface of the Fore-Arm; and that of Perforatus, from the Slits found near the Extremities of its Tendons.

It is commonly composed of four Muscles closely connected by their musculous Portions representing

there one large Body of Muscles; is fixed above to the superior internal Parts of the Ulna and Radius (this last Bone being considered in its natural Situation), and to that of the inter-osseous Ligament. A little below the Middle of the Fore-Arm this large musculous Portion is divided into four distinct Muscles, which, on the lowest Quarter of the Fore-Arm, terminate in four flat Tendons of different Sizes.

These four Tendons are inclosed in a common membranous or mucilaginous Vagina, which likewise furnishes each Tendon with a particular thin Vagina; in this Manner they advance to the Carpus, and pass under the large annular transverse Ligament: Beyond this Ligament they spread again in the Palm of the Hand, still retaining their particular Vaginæ, and run between the Aponeurosis Palmaris and Metacarpus towards the Fingers, separating by Degrees. Sometimes there are, at first, only three Tendons, one of them being afterwards divided into two, in their Passage to the Fingers; sometimes they communicate, by a kind of Detachment, with the Tendons of the Perforans.

Having reached the Heads of the metacarpal Bones, they pass under the four Arches, or Fræna, formed by the Furcæ of the Aponeurosis Palmaris and particular Septa of the great transverse Ligament of the Palm of the Hand; and then each Tendon, having got beyond the Head of one metacarpal Bone, and beyond the Basis of the first Phalanx, enters the ligamentary Vagina on the flat or internal Side of that Phalanx, and is inserted into the flat Side of the second Phalanx near its Basis, the membranous Vagina accompanying it to its Insertion. The ligamentary Vagina is stronger towards the Basis than towards the Head of the first Phalanx.

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In passing along the internal Side of the first Phalanx the Tendon is divided by a long Slit which gives Passage to a Tendon of the Perforans, and thence the Names of these two Muscles are taken.

This Fissure, or Opening, is contrived in a very singular Manner: The Tendon is first divided in two flat Portions, and each Portion is contorted on the flat Side of the Phalanx; so that the Edges which were nearest become opposite, and the opposite Margins are connected all the Way to the Extremity of the Tendon: By this Contorsion the Fissure seems to form two small oblique Sinuses, which surround the Tendon in opposite Directions, one Sinus being covered by the Tendon, and the other covering it.

Afterwards the two Portions, having formed this double Sinus by their mutual Contorsion, are not connected, only by simply approaching each other at their Extremities; for each Portion is at that Place again divided into two others smaller and shorter than the former; so that, in all, there are four narrow Portions; the two nearest of which cross each other, and join the other two: So that, from the four narrow ones, are formed two broad Portions anew, which are connected by their Margins, and afterwards inserted into the Bone at a small Distance from each other.

7. PERFORANS, or PROFUNDUS, is very much like the former, and situated much in the same Manner, only it lies deeper, and is covered by the Perforatus. It is composed of four musculous Portions, which at first seem to make but one Mass, and afterwards terminate in four Tendons.

The musculous Portions of the first and largest, and also of the second, are fixed in the superior Parts of the Ulna and inter-osseous Ligament

down to their Middle; the musculous Portion of the third is joined to the Tendon of the Ulnaris Internus by a sort of common Aponeurosis, and that of the fourth is fixed along the Ulna.

The four Tendons have often several small collateral ones, sometimes five in Number, connected to those of the adjacent Muscle as they pass under the large annular Ligament of the Carpus; but the Tendons themselves are separated from the others by thin Septa, which form a kind of particular Rings: Being thus strengthened, they separate, and running along the Palm of the Hand in distinct membranous Vaginæ, like those of the Perforatus by which they are covered, they enter the ligamentary Vaginæ of the first Phalanges, together with the former; and, having passed thro' the Fissures thereof, and through the ligamentary Vaginæ of the second Phalanges, they are inserted into the flat internal Side of the third near their Basis.

The ligamentary Vaginæ of the second Phalanges appear sometimes stronger near the Basis than near the Heads of the Bones.

8. EXTENSOR DIGITORUM COMMUNIS is a compound Muscle, very much resembling the Perforatus and Perforans, lying on the external Side of the Fore-Arm between the Ulnaris Externus and Radialis Externus, and is fixed superiorly, by a tendinous Extremity, to the posterior and inferior Part of the external or great Condyle of the Humerus; and, by a tendinous Adhesion on each Side, to the Ulnaris and Radialis Externus: It has likewise sometimes a small Insertion into the Radius. It is divided into four Portions like the Perforatus and Perforans, and four long, slender, small Tendons.

Three of these Tendons pass through the common external annular Ligament of the Carpus; and

and the fourth, which goes to the Little Finger, and has sometimes its musculous Portion distinct from the rest, passes through a particular Annulus of the same Ligament. Afterwards these four Tendons separate as they go to the Fingers, and, in their Passage, communicate with each other by oblique tendinous Series, chiefly near the Heads of the metacarpal Bones. The Tendons of the Middle and Little Fingers are sometimes double, and yet communicate with the rest.

Each Tendon, having reached the Basis of the first Phalanx, is slightly inserted therein by some lateral Expansions fixed in each Side of the Basis; thence it advances to the Head of the same Phalanx, where it is divided into two flat Portions, which, at the Articulation of the first Phalanx with the second, leave some Distance between them. About the Head of the second Phalanx they unite again, and are fixed in the convex Side of the third Phalanx near its Basis: The Separation of the two Portions is, in some sort, rhomboidal, and each Portion is strengthened by a common Tendon of the Lumbricales and Interossei. In the void Space between them are small tendinous Fræna, more or less transverse.

109. EXTENSOR INDICIS PROPRIUS is small and long, with a long slender Tendon, lying a little obliquely on the inferior and external Half of the Fore-Arm between the Ulna and Fore Finger: It is fixed, by its musculous Portion, a little higher than the lowest third Part of the external Side of the Ulna, below the Insertion of the Extensor Pollicis; and it has likewise a small Adhesion to the inter-osseous Ligament: Thence it descends, terminating in a distinct Tendon, without any Communications; which, having passed through the annular Ligament of the Extensor

Communis, afterwards joins that Tendon which goes to the Index.

10. *EXTENSOR MINIMI DIGITI PROPRIUS* is a kind of collateral or auxiliary Muscle of the Extensor Communis, of which it appears to be more or less a Portion, and is fixed along the superior external Half of the Ulna; whence its long small Tendon descends, in Company with the fourth Tendon of the Extensor Communis, all the way to the Little Finger, where it joins, and is inserted with it. Sometimes this Muscle is wanting; in which Case, the Extensor Communis sends a double, and sometimes a triple Tendon, to the Little Finger.

11. *LUMBRICALES* are four very small slender Muscles lying in the Cavity of the Hand, in the same Direction with the Perforatus and Perforans; and they are fixed, by their musculous Portions, to the Tendons of the Perforatus, on the Side next the Thumb, near the large annular Ligament of the Carpus: Near the Heads of the metacarpal Bones they become very thin Tendons, which accompany those of the Perforans through the Furcæ of the Aponeurosis Palmaris; then they pass on to the same Sides of the first Phalanges, and join the Tendons of the Extensor Communis, each of them being connected with the nearest Portion thereof at the Articulation of the first Phalanx with the second.

These Tendons are likewise united to some of the Inter-ossæ; and their Insertions seem to vary in different Subjects: For though they generally lie on that Side of the Fingers which is next the Thumb; yet we have observed the first inserted into the Index on the Side next the Thumb, the second and third on each Side the Middle Finger, and the fourth on that Side of the Ring Finger which is farthest from the Thumb.

12. INTER-OSSEI are small Muscles lying between the metacarpal Bones, and filling the three Interstices left between them, both exteriorly or towards the Back of the Hand, and interiorly or towards the Palm of the Hand. From this Situation they have their Name, and have been divided into external and internal.

They are commonly reckoned six; three external, and three internal; Regard being had only to the musculous Masses in the Metacarpus and the six tendinous Insertions into the Fingers: But, if we consider the Composition of these Masses, their Number may be increased.

The external Inter-ossei are stronger, more compound, and take up more Space between the metacarpal Bones, than the internal: Each of them is composed of two Portions; one of which appears almost on a Level with the Bones, the other hid, and which runs in upon the internal Muscles.

The apparent Portion is, in some measure, penniform, being fixed along the Sides of two Bones; and also, by a small Extremity, to the nearest Bone of the Carpus: The other Portion, which lies hid, appears more simple; and seems to be fixed only to the Bases of the same two Bones.

Near the Heads of the metacarpal Bones these two Portions of each Muscle terminate in broad flat Tendons, which, having reached the Side of the first Phalanx of one Finger, are afterwards united with the nearest Portion of the Tendon of the Extensor Communis: One Portion is likewise inserted into the Phalanx itself, by small short Tendons. These Muscles may therefore be reckoned bicipital, especially when the Tendons of the two Portions unite.

The first two external Inter-ossei are, for the most part, inserted into the Middle Finger: They fill
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the Interstices between the three first metacarpal Bones, and surround the middle Bone all the way to the Cavity of the Hand. Their Tendons are fixed in both Sides of the first Phalanx, and both Sides of the second Tendon of the Extensor Communis.

The third external Inter-osseus lies in the Interstice between the two last metacarpal Bones, and is commonly inserted into the Ring Finger, its Tendon being fixed in that Side of the first Phalanx farthest from the Thumb, and in the corresponding Margin of the third Tendon of the Extensor Communis. Its musculous Portion runs in between the two Bones, towards the Cavity of the Hand.

The internal Inter-ossei are more simple than the former, and do not lie so much between the Bones: The Tendon of the first is inserted into the Side of the first Phalanx of the Fore-Finger, next the Little Finger, and in the corresponding Margin of the Extensor Communis; the Tendon of the second goes, in the same Manner, to the Side of the Ring Finger next the Thumb; and the third, to the same Side of the Little Finger.

There are, therefore, two external Inter-ossei for the Middle Finger, one for the Ring Finger, but none for the Fore and Little Fingers. The Middle Finger has no internal Inter-osseus; but the Index, Ring, and Little Fingers, have each of them one.

The external Inter-ossei sometimes appear to be really double, the two Muscles being separated by a fatty Line; so that, in some Subjects, we have six internal Inter-ossei: But the musculous Portions on each Side of the second metacarpal Bone belong to the two first external Muscles; and the musculous Portion on the Side of the fourth metacarpal Bone next the Thumb belongs to the third

external Inter-osseus, in the Order they have been described.

13. SEMI-INTER-OSSEUS INDICIS is small, short, flat, and musculous, very much like the Anti-thenar or internal Semi-Inter-osseus of the Thumb; It is situated obliquely on one Side of that of the Thumb, between the first Phalanx thereof and first metacarpal Bone; is fixed externally, by one Extremity, to the Basis of the first Phalanx of the Thumb, and a little to that Bone of the Carpus by which this Phalanx is supported; and by the other Extremity it is fixed near the Head of the first Phalanx of the Index, on that Side next the Thumb. It lies almost parallel to the Anti-thenar, crossing it a little, this Muscle lying on the convex Side of the Hand, and the Anti-thenar on the concave Side.

14. HYPO-THENAR MINIMI DIGITI is small, and pretty long, lying posteriorly on the fourth metacarpal Bone opposite to the Thumb, where, together with the Metacarpus or Hypo-thenar Metacarpi, it forms that large Eminence over-against the Thenar or that of the Thumb. It may be called Hypo-thenar Minor, and that of the Metacarpus, Hypo-thenar Major; and is fixed, by one Extremity, in the Os Orbiculare of the Carpus, and a little to the adjacent Part of the large annular Ligament; the other Extremity terminates by a short flattish Tendon fixed to that Side of the Basis of the first Phalanx of the Little Finger which is turned from the Thumb. This Muscle covers the Metacarpus a little; and they have both been looked upon as Portions of one Hypo-thenar.

USES OF THESE MUSCLES.

The Flexor Pollicis Longus serves, chiefly, to bend the third Phalanx of the Thumb, into which it is inserted by the Extremity of its Tendon; it likewise bends the second Phalanx, by Virtue of the ligamentary Vagina, through which it passes as through an annular Ligament.

As the musculous Portion of this Muscle is very thin and narrow, it does not, at first Sight, appear to bear a sufficient Proportion to the great Force with which we constantly find it to act: But, when we consider its Structure more narrowly, we find therein a beautiful Example of a very great Number of Fibres artfully placed in a small Space only by the oblique Distribution thereof; as has been observed in the Beginning of this Lecture.

The first Extensor of the Thumb alone, when there are three, or a Portion of the first when there are but two, serves to draw the first Phalanx from the Palm of the Hand, or keep it at a Distance therefrom.

The Word Extension, made Use of to express this Motion, is very improper: For the first Phalanx of the Thumb, in its natural Situation, makes an Angle with the Radius, and, consequently, is in a State of Flexion. It ought, therefore, more properly to be said to be extended, when it is drawn near the Palm of the Hand. However, the common Terms may still be retained, if we be previously made acquainted with their true Meaning, as has been already observed in speaking of the Uses of the Ulnaris and Radialis Externi.

The second of these Muscles when there are three, or the second Portion of the first when there

are but two, serves to extend the second Phalanx on the first; and this Motion is a true Extension.

The third when there are three, or the second when there are but two, extends the third Phalanx on the second; when they act all together, they assist each other by the graduated Insertions of their small subaltern Tendons.

These Muscles may likewise assist in the common Action of the two Radiales, that is, in bringing the great or internal Margin of the Hand towards the convex Side of the Radius; and they, probably, have likewise some Share in the Motion of Supination.

The Thenar, by its Insertion into the first Phalanx of the Thumb, serves to draw it from the first Bone of the Metacarpus, more or less directly, as one of its Portions acts more than the other, or as they both act equally. By the Insertion of the large Portion into the Basis of the second Phalanx by the Intervention of the sesamoid Bone of the same Side, it may bend this Phalanx laterally on the first, and thereby bring the Thumb to a greater Distance from the Index. Neither does this Distance hinder it from sometimes bending and extending the Thumb in the ordinary Manner.

When the small Portion acts alone, it may give the second Phalanx a small Degree of Rotation on the first, these two Bones not being articulated by a Ginglymus.

The Meso-thenar moves the first Phalanx of the Thumb towards the Cavity of the Hand, more or less obliquely, as it acts either alone, or with the large Portion of the Thenar, or even with the Anti-thenar. By its Insertion into the sesamoid Bone of the second Phalanx, it likewise moves that Phalanx on the first, and thereby assists the Flexor Longus.

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The Anti-thenar moves the first Phalanx of the Thumb towards the first Bone of the Metacarpus, and thereby presses the Thumb laterally against the Index. This Motion becomes more or less oblique by the Co-operation of the Meso-thenar.

The Perforatus serves to bend the second Phalanges of all the Fingers except the Thumb; and the particular Muscles, of which it is composed, may act separately, by reason of their distinct Insertions into these Phalanges. The Connexion of the musculous Portion, by the middle tendinous Septa, may have several Uses; the chief of which is, that these Septa, being very broad and thin, give Insertions to a great Number of musculous Fibres in a very small Compass, and thereby supply the Place of four large Tendons, which would have taken up much more Room; but, by this Union, these four Muscles are more disposed to act jointly than separately.

They not only bend the second Phalanges on the first, but also the first on the metacarpal Bones, and the Metacarpus and Carpus on the Fore-Arm. To conceive the Mechanism and Force of these Muscles, which is very great and necessary, in certain Circumstances; we must call to Mind an Observation, already made, concerning the Muscles of the Scapula; that every Muscle, which can move a Bone in any given Direction, is likewise able, with the same Force, to keep it immovable, in any Situation, against whatever tends to move it in a contrary Direction. The following Examples will sufficiently illustrate this Observation.

It is by bending the Fingers we raise the greatest Weights; that Sailors pull large Oars; Printers turn the Screws of their Presses, and Climbers support their whole Bodies, even with an additional Burden upon them. It is by means of the

the Fingers, when bent, that we tear, pull up, bruise, &c. Things which require a very great Force to tear, pull up, or bruise*.

In this Muscle we meet with both these Contrivances; a great Number of Fibres for Strength of Motion, and a great Length of Fibres for Extent of Motion.

The different tendinous Septa serve to give Insertions to a Number of moving Fibres sufficient for the Strength required in the Cases already mentioned.

Large Degrees of Motion are likewise sometimes very necessary in this Muscle. For instance, when we bend the Fingers at the same Time that the Metacarpus and Carpus are bent on the Fore-Arm; and, in this Case, certain Fasciculi of Fibres are chiefly employed which appear to be longer than the rest. The particular Uses of the Tendons of this Muscle, will be better understood with that of the Perforans.

The Perforans bends, particularly, the third Phalanges, into which it is inserted; and, by the same Motion, it may likewise bend the first and second Phalanges. We may apply to this Muscle all that has been said concerning the tendinous Septa in the Perforatus, and its Action, which is sometimes common to all the four subaltern Muscles, sometimes peculiar only to one or more of them.

* It was observed, in the Beginning of this Description of the Muscles, that the Strength of Muscles depends on the Multitude of their musculous Fibres; and the Extent of their Motions on the Length of these Fibres; and, consequently, wherever Strength is more necessary than great Degrees of Motion, there we find the Fibres of Muscles proportionably increased in Number; and wherever there is more Occasion for a large Degree of Motion than Strength, the musculous Fibres are of a proportionable Length.

It may likewise be esteemed an Assistant to the Ulnaris and Radialis Internus, in great Efforts; and these Muscles may, reciprocally, be looked upon as Assistants to the Perforatus and Perforans.

Each of these four Tendons passes under a distinct annular Ligament, as under a Pulley. For having accompanied that of the Perforatus thro' the great Ligament of the Carpus, through the Furcæ of the Aponeurosis Palmaris, and through the ligamentary Vaginæ of the first Phalanx; and having passed through the Slits of the Perforatus; it leaves this Tendon, and continues its Course to the third Phalanx through the ligamentary Vagina of the second.

In its Passage through the Slit of the Perforatus it is liable to no Compression; even in the most violent Efforts of that Muscle. The reciprocal Contorsions of the two flat Portions of the Fissure, and their cervical Insertion into the flat Side of the third Phalanx, hinder the small oblique Sinuses, mentioned before, from closing, and the two lateral Portions of the Fissure from joining, even after the Tendon of the Perforans has been removed: And the more this Part of the Tendon is pulled, the more perfectly does this Fissure form a Sort of Sulcus with solid Sides, and with the two Ends cut obliquely.

Without such an artful Structure as this, the Tendon of the Perforans would have been continually exposed to Compressions and Contusions by the Sides of an ordinary Fissure; and, without passing through the Tendon of the Perforatus, it could not have been inserted into the Middle of the flat Side of the third Phalanx, but near one of the Margins.

In the Insertion of these two Tendons of the Phalanges we may observe still a farther Contrivance. This Insertion is angular in both; that is, the Extremities of the Tendons are not inserted, according to their Breadth, in a transverse Line; but the Sides of their Breadth make an Angle with the Middle. This Circumstance was wilfully passed over elsewhere.

The Extensor Digitorum Communis serves to extend the four Fingers, keep them in any Degree of Extension, and moderate their Flexion in all the determinate Degrees of Action of the Perforatus and Perforans. The Composition of the Fibres of this Muscle, and its Division into several subaltern Muscles, are much the same with what we have already seen in the two former. Each of these subordinate Muscles may act separately, but with more Difficulty than the other two, because of the collateral Series between the Tendons.

The particular Use of these communicating Portions is, to move the Fingers laterally when extended, draw them nearer, or to a greater Distance from each other, and also to serve as Fræna, instead of Vaginæ. These Motions being unnecessary when the Fingers are bent, the Perforatus and Perforans have none of these communicating Portions. Each Tendon serves to extend a whole Finger, that is, all the three Phalanges together; and likewise each Phalanx by itself, tho' not with the same Facility. The three Phalanges being bent, we can easily extend the first without the other two; but it is difficult to extend the second Phalanx without extending the third.

The Contrivance for the general Extension of the three Phalanges, by one Tendon, chiefly consists in the rhomboid Fissure, in that Tendon, on the second Joint, or that of the second Phalanx

with the first, and in the tendinous Expansions on the Sides of the Bases of the first Phalanx: To these we must add a short tendinous Production from the internal Side of the Tendon, near the first Angle of the rhomboid Fissure, inserted into the Basis of the second Phalanx. This Production has been omitted.

The lateral Expansions extend the first Phalanx, the Production just mentioned extends the second, and the last Angle of the rhomboid Fissure the third; two other Angles being kept separate by auxiliary Muscles.

The Difficulty we find in extending the second Phalanges without extending the third, and in extending the third without the second, is partly owing to the two strong Flexors inserted into these Phalanges, which are seldom contracted or relaxed separately, without a particular Habit; and it is for the same Reason that we cannot easily bend one of these Phalanges, without bending the other, except we have been long accustomed to it.

The proper Extensors of the Fore and Little Fingers are Assistants to two subaltern Muscles of the Extensor Communis that go to these Fingers; which, consequently, we extend separately with more Ease than either of the other two. These Muscles likewise serve to bring the Fingers, into which they are inserted, near the other Fingers.

We may be convinced of this last Use, by touching these Muscles when we hold our Fingers close together, or move them laterally, whether extended, or in any other unconstrained Posture, between Extension and Flexion. The same Experiment may be made with Relation to the Middle and Ring Fingers.

Among the long Muscles which cover the Bones of the Fore-Arm, those which extend the Carpus and Fingers are fixed in the external Condyle of the

the Humerus, or near it, on the same Side. Those which bend the same Parts are fixed in the internal Condyle, or near it, on the same Side.

This Disposition is very favourable to the Action of the Pronators and Supinators, which otherwise must have been obstructed; and these Muscles must likewise have hindered the Action of the Flexors and Extensors; and they would mutually have been exposed to Contusions and Bruises. For were the Flexors fixed on the Side of the external Condyle, they must cross over the Radius, because of their Insertions near the Palm of the Hand; and if the Extensors were fixed near the internal Condyle, they must cross the Ulna in Pronation; and, in that Case, could not act freely.

The Lumbricales, by the Union of their Tendons with those of the Inter-ossei, are Co-adjutors to these Muscles, not only in the lateral Motions of the four Fingers, but also in bending and extending them. In the lateral Motions they co-operate, according to their Situation, in each Subject; and it is possible that the Variety of their Insertions answers to that of the Inter-ossei: So that the reciprocal Co-operation continues still to be equal.

They assist the great common Flexor, to which they are fixed, only in bending the first Phalanges; which Motion that Muscle principally performs by means of the ligamentary Vaginæ, especially that Portion of them which is next the Metacarpus.

They may assist the Extensor Communis in extending the third Phalanges, together with the Inter-ossei, by the Concurrence of their Tendons: But here the Variety of their Insertions is likewise to be regarded; and, in some Subjects, the Want of them in that Side of the Index next the Thumb and Side of the Little Finger farthest from the

Thumb, may be supplied by the proper Extensors of these Fingers.

The Inter-ossei may have two Uses, according to their different Insertions, and the different Situations of the Fingers into which they are inserted. In general they assist the Extensor Communis by their Insertions into the lateral Angles of the rhomboid Fissures; for thereby they act like lateral Ligaments, which, together with the Tendons of the Extensor, serve to extend the third Phalanx of each Finger. By the same lateral Insertions they perform the lateral Motions of the Fingers, that is, they press them all close against each other, but do not separate them all, nor move each Finger, in particular, towards or from the Thumb. In a general Separation of all the Fingers, the Inter-ossei move only the Middle and Ring Fingers, the Index and Little Finger being separated by other Muscles; in the Motion of the Fingers towards the Thumb, which is called Adduction, they act only on three Fingers; the Middle, Annular, and Little: In the contrary Motion, or Abduction of the Fingers, they move likewise three; viz. the Index, Middle, and Annular.

The Uses of the Inter-ossei, in particular, whether external or internal, may be different in different Subjects, according to the Variety of their Insertions; and therefore, in living Bodies, nothing can be determined about them.

According to the Situation in which they have been described, the first and second external Inter-ossei perform, alternately, the Adduction and Abduction of the Middle Finger; the third performs the Abduction of the Annular, that is, moves it towards the Little Finger. The first internal Inter-osseus makes the Abduction of the Index, or moves it towards the Middle Finger;
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the second makes the Adduction of the Annular, by moving it, likewise, towards the Middle Finger; and the third performs the Adduction of the Little Finger, or moves it towards the Middle one.

The Use of the Semi-Inter-osseus Indicis is, to move the first Phalanx of the Index more or less directly towards the great Margin of the Metacarpus, by removing it from the Middle Finger. This Motion is not a true Adduction of the Index towards the Thumb; and, indeed, the Terms of Adduction and Abduction are very improper to convey a just Idea not only of the lateral Motions of the Index, but of all the other Fingers.

The Hypo-thenar Minor serves to separate the Little Finger from the rest, which Motion is commonly called Abduction; it likewise keeps this Finger separated in all Situations, that is, in all Degrees of Flexion or Extension.





LECTURE XIV.

Of the Muscles which move the HEAD, TRUNK, and NECK.

THE HEAD has proper Motions, distinct from those of the NECK; and others, common to it with the same. The Muscles which serve particularly for these Motions are of two Kinds; some of them being fixed, by one Extremity, in the Head; and the rest having no Insertion into that Part.

Those of the first Kind are commonly twenty; to which four more are added, though they have no Insertion on the Head: Their Number, therefore, amounts to twenty-four; twelve lying on each Side.

I. STERNO-MASTOÏDÆUS, or MASTOÏDÆUS ANTERIOR, is long, narrow, pretty thick, and mostly musculous, situated obliquely between the posterior Part of the Ear and inferior Part of the Throat: It is, in a Manner; composed of two Muscles connected superiorly through their whole Breadth, and separated inferiorly. It has two Insertions below, both of them flat, and a little tendinous: The first is in the superior Margin of the Sternum, near the Articulation of the Clavicula; the other in the Clavicula, at a small Distance from the Sternum. These two Portions ascend

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obliquely, and unite at about an Inch above their inferior Insertions; the triangular Space between them being filled by a Membrane. The sternal Portion passes anteriorly, and covers the Clavícula, both forming one Body; which, running in the same oblique Direction to the Apophysis Mastoïdæus, is inserted into the superior and posterior Parts of that Process; over which it likewise sends off a very broad Aponeurosis, which covers the Splenius, and is inserted into the Os Occipitis.

The two anterior Mastoïdæi represent a great Roman V, the Angle being at the inferior Part of the Throat, and the two Crura ascending behind the Ears, as may be plainly seen, without Dissection*.

2. SPLENIUS, or MASTOÏDÆUS POSTERIOR, is flat, broad, and oblong, situated obliquely between the posterior Part of the Ear and the posterior and inferior Parts of the Neck: It is partly single, and partly composed of two Portions, one superior, the other inferior; these two Portions are closely connected posteriorly, making only one Plane; but they are divided superiorly.

The superior Portion is fixed to the Extremities of the three or four inferior spinal Apophyses of the Neck, and of the first, or first and second, of the Back: It is not fixed immediately to the cervical Apophysis which is above the last, but only by the Intervention of the posterior cervical Ligament; it is likewise fixed to the Margin of the inter-spinal Ligaments of the other Vertebræ, and

* A wry Neck is commonly said to proceed from the Mastoïdes being paralytic; therefore an Incision is made in that Side on which the mastoïd Muscle is extended. However, it is seldom of any Service, as WINSLOW has rightly observed, in his Memoirs to the ROYAL ACADEMY of PARIS.

therefore its Insertions into the spinal Apophysis are not interrupted by the Distances between these Apophyses, but from one thin continued Plane a little tendinous. Thence it ascends obliquely towards the mastoid Apophyses, partly under the superior Extremity of the Sterno-Mastoïdæus, and is inserted into the superior Part of that Process, and along the adjacent curve Portion of the transverse Ridge of the Os Occipitis.

The inferior Portion of the Splenius is fixed to three or four spinal Apophyses of the Back, beginning by the second or third; thence it ascends, being closely connected to the other Portion till it reaches the superior and lateral Parts of the Neck, where it separates, and is inserted into the transverse Apophyses of the three or four superior cervical Vertebrae by the same Number of Extremities, a little tendinous, which, however, are sometimes only two. This Portion of the Splenius belongs rather to the Neck, than Head.

The two Splenii represent a capital Roman V; and the Splenius and Sterno-Mastoïdæus, of the same Side, form a Figure like a Roman A, or the Legs of a Pair of Compasses, the Points whereof are in an horizontal Plane. Thus these four Muscles, surrounding the Neck, meet alternately at their superior and inferior Extremities.

3. **COMPLEXUS** is pretty long and broad, lying on the posterior lateral Part of the Neck quite to the Occiput: It is complicated, by reason of the Decussations of its different Portions, from which it has its Name; but is commonly looked upon to be one Muscle. It is fixed inferiorly, by small short Tendons, to the transverse Apophyses of all the cervical Vertebrae except the first, to which it is fixed only near the Basis of its transverse Apophysis; thence it ascends obliquely backwards, crossing under the Splenius, and often
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communicating with it by some Fasciculi of Fibres; it is afterwards inserted superiorly, by a broad musculous Plane, into the posterior Part of the superior transverse Line of the Os Occipitis, near the Crista or Spine of that Bone. At its Insertion it connects, by one Margin, the Complexus of the other Side; and, by the other, the Splenius, which covers it a little*.

4. COMPLEXUS MINOR, or MASTOÏDÆUS LATERALIS, is long, slender, narrow, and indented, lying along all the Side of the Neck up to the Ear, where it increases a little in Breadth: It is somewhat like the Complexus Major; and VESALIUS took it to be a Portion of that Muscle. It is fixed, by one Extremity, in all the transverse cervical Apophyses except the first, by the same Number of Digitations or Rami, mostly musculous, and disposed obliquely; thence it ascends, and, having reached above the transverse Apophysis of the first Vertebra, forms a small broad Plane, by which it is inserted into the posterior Part of the Apophysis Mastoïdæus. It is here covered by the Splenius, and covers a little the Obliquus Superior. This Muscle is often mistaken for a Portion of the Longissimus Dorsi.

5. RECTUS MAJOR is small, flat, and short; broad at the superior, and narrow at the inferior Part. Though it is called Rectus, it is situated obliquely between the Occiput and second cervical Vertebra; and is fixed inferiorly to one Ramus of the bifurcated Spine of the second, at a Tuberosity which is often found at the superior Part of that Ramus; thence it ascends a little obliquely outwards, and is inserted into the posterior Part

* Before we dissect the Splenii, we may see, in the Interstice left between their superior Portions, the two Complexi connected on the Spine of the Os Occipitis.

of the inferior transverse Line of the Os Occipitis, at a small Distance from the Crista, being a little covered by the Obliquus Superior.

6. RECTUS MINOR is like the former Muscle, and has also a small Insertion below, in the posterior Eminence of the first Vertebra; thence it ascends laterally, and is inserted, immediately under the posterior Part of the inferior transverse Line of the Os Occipitis, into a superficial Fossula on one Side of the Crista Occipitalis.

7. OBLIQUUS SUPERIOR, or MINOR, is situated laterally between the Occiput and first Vertebra, being nearly of the same Figure with the two Recti: It is fixed to the Extremity of the transverse Apophysis of the first Vertebra, thence it ascends obliquely backwards, and is inserted into the transverse Line of the Os Occipitis, almost at an equal Distance from the Crista and mastoid Apophysis, between the Rectus Major and Complexus Minor, which covers it a little.

8. OBLIQUUS INFERIOR, or MAJOR, is situated, in a contrary Direction to the Obliquus Superior, between the first and second cervical Vertebrae, resembling that Muscle in every Thing but the Size: It is fixed inferiorly to one Ramus of the bifurcated spinal Apophysis of the second Vertebra, near the Insertion of the Rectus Major; thence it ascends externally oblique, and is inserted into the Extremity of the transverse Apophysis of the first Vertebra under the inferior Insertion of the Obliquus Superior.

9. RECTUS ANTICUS LONGUS is, in some measure, of a pyramidal Figure, lying along the anterior and lateral Parts of the cervical Vertebrae; all the Way up the Basis Cranii: It is fixed to the anterior Parts of the transverse Apophyses of the third, fourth, fifth, and sixth Vertebrae, in a digitated Manner; thence it ascends, interiorly oblique,

lique, towards the lateral Parts of the Bodies of the Vertebrae, passes on anteriorly to the first and second without being inserted into them, as approaching gradually towards the same Muscle on the other Side; and is inserted, near it, into the anterior Part of the inferior Side of the Apophysis Basilaris, or large Apophysis of the Os Occipitis.

10. RECTUS ANTICUS BREVIS is a small flat Muscle, about the Breadth of one Finger, situated laterally on the anterior Part of the Body of the first Vertebra, and fixed to the Radix of the transverse Apophysis of that Vertebra near the anterior Eminence; thence it ascends, obliquely and interiorly, to a transverse Impression in the inferior Side of the Apophysis Basilaris of the occipital Bone, immediately before the Condyle on the same Side, being covered by the Rectus Anticus Longus.

11. TRANSVERSALIS ANTICUS PRIMUS is small, pretty thick, and wholly musculous, about the Breadth of a Finger, situated between the Basis of the Os Occipitis and the transverse Apophysis of the first Vertebra: It is fixed, by one Extremity, to the anterior Part of that Apophysis, and thence ascending a little obliquely, is inserted, by the other Extremity, into a particular Impression between the Condyle of the Os Occipitis and the mastoid Apophysis of the same Side, behind the styloid Apophysis, and under the Margin of the jugular Fossula.

12. TRANSVERSALIS ANTICUS SECUNDUS is small, and situated between the transverse Apophyses of the two cervical Vertebrae: It is fixed, by one Extremity, very near the Middle of the second Apophysis; and, by the other, near the Radix of the first; and is therefore rather a Muscle of the Neck than Head, as it does not reach the latter.

13. MUSCULI ACCESSORII are small Muscles, which we sometimes meet with, fixed by one End, to the Extremity of the first transverse cervical Apophysis near the Insertions of the two Obliqui, whence ascending obliquely, it is again inserted behind the mastoid Apophysis. These Muscles are commonly thought to be a third small Transversalis on that Side where it is found, but it seems rather to be an additional Muscle to the Obliquus Superior: The Recti and other Obliqui are likewise sometimes found double*.

USES OF THESE MUSCLES.

The Action of the Sterno-Mastoïdæi is different, according as either both Muscles, or only one of them, acts; and according to the different Situations of the Head and Trunk.

When we keep them strait, whether in standing or sitting, both Muscles preserve the Head in that Posture, against any Force by which it would otherwise be moved backwards. This we may be convinced of, by laying the Hand on these Muscles while we endeavour to resist a Force which pushes back the Head.

One of these Muscles, acting alone, may have the same Use, if the Force to push the Head back be applied between the anterior and lateral Parts of it. In that Case, the Sterno-Mastoïdæus, on the same Side, would oppose this Force; but if it was applied directly on the Side of the Head, that Opposition would have no Effect, without the Assistance of the Splenius on the same Side.

* I call all these Muscles ACCESSORII, or Supernumerary, because they are sometimes wanting; and because, when they are found, they vary, both in Number and Situation. WINSLOW.

They both serve likewise to perform the Rotations of the Head, that is, to make it turn to either Side as on a Pivot; and in this Case, when we turn the Head to one Side, the Sterno-Mastoïdæus, on the other, acts, and not that on the same Side. This is an Observation of Consequence in paralytical Disorders.

They both serve, also, to bring the Head near the Thorax when we lie on the Back, or bend backwards in sitting; and the lower the Head is, in these Situations, the more Force must these Muscles exert to raise it. In this Case, the Sternum, being the fixed Point, must remain immoveable; but as its Connexion with the first Rib, and the Inflexibility of the Cartilage of that Rib, are not always sufficient for this; the Musculi Recti of the Abdomen must lend their Assistance in great Efforts.

In most People we may feel this Co-operation of the abdominal Muscles in raising the Head when they lie on their Back, by laying the Hand on these Muscles; but when the Cartilage of the first Rib is very much hardened, and the Articulation quite deprived of Motion, as where the first and second Ribs are partly confounded together, Instances of which have been met with in such People; the Sternum does not want any other Assistance to keep it immoveable; and therefore the Co-operations of the Muscles of the Abdomen would not be perceptible.

When, being in an erect Posture, either standing or sitting, we depress the Head, the Sterno-Mastoïdæi do not act; nor have they any Share in that Posture: It is produced only by the Relaxation of the posterior Muscles by which, alone, the Head is sustained in this erect Posture, and without which it would naturally fall forwards; as we see in those
who

who fall asleep, or are taken ill suddenly, while sitting.

The Insertions of these Muscles into the posterior Part of the mastoïd Apophyses has made some Anatomists believe that they are more proper to bend the Head backwards than forwards, their Insertions being behind the condyloïd Articulation of the Os Occipitis: And to this they might have added, that the Neck, from the natural Disposition of the Vertebrae, is better fitted for Flexion backwards than forwards.

But, in the first Place, as these Insertions take up a great deal of Room, the moveable Point can only be determined to that Part which is nearest the musculous Portion, and the most anterior; and, consequently, not situated so far backwards as is imagined.

Secondly, As the Motion of the Head forwards, by these Muscles, is distinct from that of the Neck; the anterior Muscles of the cervical Vertebrae must act, at the same Time, and hinder them from bending backwards: So that, in this Case, the Neck may be looked upon as a Pillar, the superior Part of which supports the Head; while the Head, acted upon by the Muscles, carries the inferior Part of it forwards. It is for want of this Co-operation that Experiments, made on dead Bodies, have been apt to mislead.

The two Splenii serve to support the Head in an erect Posture, whether in sitting or standing; to moderate the Flexion of the Head forwards, and bring it back to its natural Posture.

They serve, alternately, to co-operate with either of the Sterno-Mastoïdæi for the Rotation of the Head. Thus, when the right Sterno-Mastoïdæus turns the Head, the left Splenicus corresponds with it by its superior Part, while the inferior,

rior, at the same Time, turns the cervical Vertebrae.

When we lie on one Side, and raise the Head laterally, the Splenius and Sterno-Mastoïdæus, of the opposite Side, act jointly; also, when we stand and incline the Head to one Side, it is the Splenius and Sterno-Mastoïdæus of the other Side which moderate the lateral Flexion, and afterwards extend the Head: And as the Sterno-Mastoïdæus is partly inserted into the Clavicula, the Latissimus Dorsi likewise concurs in this Action, and fixes the Clavicle by means of its Connexion with the Humerus, which is of considerable Advantage in the Action of the Sterno-Mastoïdæus.

The Complexi are Assistants to the Splenii in keeping the Head strait in sitting or standing, to hinder it from inclining forwards, and to raise it, when inclined. When they act together, they, as well as the Splenii, may move the Head backwards, while the Trunk is bent forwards, or when we lie upon the Belly. This last Motion is commonly called Extension; the other Flexion.

When the Splenius and Complexus of one Side act together, they may support the Head when obliquely inclined to the opposite Side; bring it back to its natural Situation, and incline it obliquely towards the Side on which they lie.

The Recti Majores and Minores Postici, and Obliqui Superiores, turn the Head a little backwards on the first cervical Vertebra; and they can neither act otherwise, nor separately. The Recti Majores contribute most to this Motion; and the Minores likewise seem to hinder the articular Membranes from being pinched between the Bones, in large Motions.

The Recti Majores and Minores Antici, and the two Transversales Antici, move the Head forwards on the first cervical Vertebra; and the Recti Mi-
nores

nores and Transversales Breves likewise defend the capsular Ligaments.

The Obliqui Inferiores or Majores are true Rotators of the Head, by turning the first cervical Vertebra upon the odontoid Apophysis of the second; all which alternate Motions the Head follows, without being hindered in the Motions forwards and backwards, in any Degree of Rotation.

These oblique Muscles cannot perform any other Motions, being only Assistants to the Splenii and Sterno-Mastoidei. The Obliqui Minores can have no Share therein, they being limited to the Inflexion backwards, as has been already said. The Obliquity of their Direction, which may have deceived some Anatomists, seems only to be contrived to make way for the Insertions of the Complexi Minores.

Of the Transversales Antici, the first only move the Head in the Manner before mentioned; nor can they perform any other Motions, their Insertions being confined to the Os Occipitis and first cervical Vertebra. The Transversales Antici Secundi have no Share in the particular Motions of the Head, but ought rather to be ranked among the Muscles which move the cervical Vertebrae.

The Complexi Minores belong to the Head only by their superior Portions, the other Portions belonging rather to the Neck. They may serve, alternately, in the lateral Motions of the Head, and thereby co-operate with the Splenius and Sterno-Mastoideus of the same Side, when these two act together; and may likewise be of Use to observe the capsular Ligaments to which they adhere.

OF THE VERTEBRAL MUSCLES IN GENERAL.

Those which lie along the Spine, the greatest Part whereof serve for the Motion of the Neck, Back, and Loins, have, by the greatest Anatomists, been thought very difficult to be well dissected, and clearly described, especially those of the Back. All these Muscles are very complex, interwoven with each other, and multiplied in various Manners; so that it becomes necessary either to make their Number much greater than that of the Vertebrae, or to reduce them to a small Number of long Muscles intersected at different Places.

STENO, in order to facilitate the Knowledge of Dissection, and Description of these Muscles, thought proper to rank them in the following Manner: By vertebral Muscles he understands those which are fixed in the Vertebrae alone; and distinguishes them all into RECTI and OBLIQUI.

The RECTI are those which run parallel to the Medulla Spinalis, or whose Direction is longitudinal.

The OBLIQUI are those which run obliquely between the spinal and transverse Apophyses.

He divides the RECTI into MIDDLE and LATERAL. The MIDDLE RECTI are those which are fixed to the spinal Apophyses; the LATERAL those fixed to the transverse Apophyses.

He also divides these Muscles into SIMPLE and COMPOUND; the first being those which are fixed in two Vertebrae only; the last those fixed in more than two.

The OBLIQUI, according to him, are also of two Kinds. Some ascend from the transverse to the spinal Apophyses, converging towards each other; others ascend from the spinal to the transverse Apophyses, diverging from each other. The

first Sort he terms *AD MEDIUM VERGENTES*, the second *A MEDIO RECEDENTES*. These Terms are borrowed from Optics; and, accordingly, these two Kinds of Muscles might be named converging and diverging Muscles. Lastly, He adds, that several Muscles of the first Kind go from one transverse to several spinal Apophyses; and from several transverse to one spinal Apophysis.

According to this Account of the vertebral Muscles, the antient Terms of *SPINALES TRANSVERSALES* and *SEMI-SPINALES* may still be applied to them; understanding, by *SPINALES*, those Muscles which are wholly fixed in the *SPINAL APOPHYSES*; by *TRANSVERSALES*, those which are wholly fixed in the *TRANSVERSE APOPHYSES*; and by *SEMI-SPINALES*, those which are fixed in the *SPINAL APOPHYSES* by one Extremity only. At present the two Kinds of oblique vertebral Muscles are better expressed by the two compound Terms *TRANSVERSO-SPINALES* and *SPINO-TRANSVERSALES*.

It is, however, still necessary to retain the general Names of *VERTEBRALES RECTI*, *VERTEBRALES OBLIQUI*, &c. because, tho' the Terms already mentioned agree very well to the *POSTERIOR OBLIQUI*, they cannot be applied to the *ANTERIOR*, one Extremity of which is not fixed in the spinal Apophyses, but in the Portions of the *Vertebræ*.

The small simple Muscles which go only between two *Vertebræ*, may be termed *VERTEBRALES MINORES*; and the large compound Muscles which reach several *Vertebræ*, *VERTEBRALES MAJORES*; both Sorts being afterwards divided into *SPINALES* and *TRANSVERSALES MAJORES* and *MINORES*. The small Muscles are likewise called *INTER-SPINALES* and *INTER-TRANSVERSALES*; and as there are some small oblique Muscles which cannot

cannot be said to reach either the transverse or spinal Apophyses, these may be termed, simply, *INTER-VERTEBRALES*.

The *TRANSVERSO-SPINALES*, which go from several transverse to one spinal Apophysis, are disposed in this Manner: The Portion that comes from the most distant transverse Apophysis is inserted into the Extremity of the spinal Apophysis; the Portion from the next transverse Apophysis is inserted more laterally; and the same Rule holds in all the other Portions, except that which comes from the transverse Apophysis which is nearest the spinal. The last Portion is not fixed in the spinal Apophyses, but rather in the Radix of the transverse Apophysis; so that it is more properly *INTER-VERTEBRALIS* than *TRANSVERSO-SPINALIS*.

Thus in the *Transverso-Spinales* which go from the ninth, eighth, seventh, and sixth transverse Apophyses of the Back to the fifth spinal Apophysis of the same Class, we find, that the last and smallest is fixed in the Basis of the sixth transverse and of the spinal Apophysis.

The *Transverso-Spinales* which go from one transverse to several spinal Apophyses, are disposed in this Manner: The Portion which goes from or near the Basis of the transverse Apophysis, is fixed either in or near the Basis of the spinal, immediately above it; the next Portion, which is more distant from the Basis of the transverse Apophysis, ascends beyond the next spinal one, and is inserted into that above it, a little farther from the Basis.

The other Portions observe the same Order, that which comes from the Apex of the transverse Apophysis being inserted into the Apex of the most distant spinal. From this Disposition we see, that the most superior vertebral Muscles, which go from one transverse to several spinal Apophyses,

are the most inferior of those which go from several transverse to one spinal Apophysis.

It must be observed, that, in speaking of the oblique vertebral Muscles, we consider their Direction from below upwards, and not the contrary; because the inferior Vertebræ commonly support the superior, unless when any one stands upon his Head with his Feet erect: In which Case, the superior Vertebræ sustain the inferior.

We ought likewise to remark, that, in speaking of these Muscles, the Term TRANSVERSALIS is more proper than TRANSVERSUS; which last points out a certain Direction very different from that which these Muscles have: Whereas the other marks the Relation they have to the transverse Apophyses.

Besides the vertebral Muscles properly so called, several others, not inserted wholly into the Vertebræ, serve to move them. Some of the Antients called these SEMI-SPINALES, to distinguish them from those they termed SPINALES, which included all the vertebral Muscles: And therefore, as we have called these VERTEBRALES, the others may be named SEMI-VERTEBRALES.

Among the former, properly so called, some, from their Insertions, seem to be common to the Neck and Back, others to the Back and Loins; but, for Distinction's sake, we reckon, among those of the Neck, not only the Muscles entirely fixed in the Vertebræ thereof, but also those whose superior Insertion is in the seventh cervical Vertebra, tho' all their other Insertions are in those of the Back: And we observe the same Method with respect to the Loins.

All these Muscles vary very much in their Insertions and reciprocal Communications, by which last they are often so much confounded, that it is
very

very difficult for those who are not previously acquainted with them to distinguish them. In general, they are more easily distinguished in Children than Adults; and in Adults, than very aged Persons.

In describing these Muscles we shall confine ourselves chiefly to what has been most commonly observed, without pretending to contradict or discredit what other eminent Anatomists have published about them.

OF THE CERVICAL MUSCLES IN PARTICULAR.

The Muscles which move the Neck, in particular, are many, as has been already observed in speaking of the vertebral Muscles in general: But, in order to avoid all Confusion, and to form easily an Idea of them, they may be taken collectively, and thereby reduced to twelve, six on each Side; of which, one is situated anteriorly on the Neck, the rest posteriorly.

The Muscle which, with its Fellow, lies on the Neck anteriorly, viz.

I. LONGUS-COLLI, is composed of several others, situated laterally along the anterior Side of all the cervical Vertebrae, and some of the superior Dorsals. It may be divided into two Portions: One superior, consisting of oblique converging Muscles; and one inferior, composed of oblique diverging ones.

The superior Portion is covered by the Rectus Anticus Longus of the Head. The Muscles, of which it consists, are inferiorly fixed to all the transverse Apophyses which lie between the first and last Vertebrae; thence they ascend obliquely, and are inserted into the anterior Eminence of the first Vertebra and the Portions of the three following.

The Insertion of the first Eminence is so closely united to the Ligament which goes to the Os Occipitis, that it can hardly be distinguished from it.

The inferior Portion appears almost strait; and yet all the Muscles which compose it are diverging, or directed externally oblique. They are inferiorly fixed to the anterior lateral Part of the Body of the last cervical Vertebra and of the first three of the Back, and sometimes more; thence they ascend externally a little obliquely, and are inserted near the transverse Apophyses of all the cervical Vertebrae except the first and last.

Though these two Portions seem to be confounded with each other, they may, notwithstanding, be easily distinguished, by an oblique Line that runs between them from the transverse Apophysis of the second Vertebra to the Portion of the sixth. All the Insertions of this Muscle are more or less tendinous.

2. TRANSVERSALIS COLLI MAJOR is a long thin Muscle, placed along all the transverse cervical Apophyses and the four, five, or six, superior dorsal ones, between the Complexus Major and Minor; lying, as it were, on the Insertions of the first of these Muscles. It is composed of several small muscular Fasciculi, which run directly from one or more transverse Apophyses, and are sometimes inserted into that nearest to these, sometimes into others more remote; the several Fasciculi crossing each other between the Insertions of the two Complexi, which are likewise crossed by them. They have sometimes a Communication with the Longissimus Dorsi; but this is not uniform.

3. TRANSVERSALIS GRACILIS, or COLLATERALIS COLLI, is a long thin Muscle, resembling the Transversalis Major in every Thing but Size, and situated on the Side of that Muscle. It is
com-

commonly taken for a Portion or Continuation of the Sacro-Lumbaris.

DIEMERBROECK distinguished it by the Name of CERVICALIS DESCENDENS; and STENO, and others after him, have called it ACCESSORIUS MUSCULI SACRO-LUMBARIS; in describing which Muscle, I shall have Occasion to mention it again.

4. SEMI-SPINALIS, or TRANSVERSO-SPINALIS COLLI, is a Name given to all that musculous Mass which lies between the transverse and spinal Apophyses from the second cervical Vertebra to the Middle of the Back; the Splenius and Complexus Major, which cover it, having been raised. It is composed of several oblique converging Muscles, which may be divided into external and internal; and, of these, the external are longest.

The first are fixed inferiorly to the transverse Apophyses of the sixth, seventh, eighth, or ninth, superior dorsal Vertebrae, by tendinous Extremities, which, as they ascend, become musculous, and mix with each other. Their superior cervical Insertions are six; the first whereof, which is tendinous, is in the seventh spinal Apophysis; the rest, which are musculous, are in the five next spinal Apophyses. The lowest of these external Muscles mix, more or less, by some communicating musculous Fibres, with the Spinalis, Longissimus, and Semi-Spinalis Dorsi.

The internal are shorter, and more oblique, than the external, and partly covered by them: They are fixed, by their inferior Extremities, to the transverse Apophyses of the three or four superior dorsal Vertebrae, and to the oblique Apophyses of the four or five inferior cervical Vertebrae; and, by their other Extremities, are inserted into the six spinal cervical Apophyses. Some of these internal Muscles are very short, lying wholly between the

spinal Apophyses and the oblique or transverse ones next them.

5. SPINALES COLLI MINORES lie between the six spinal cervical Apophyses and the last cervical and first dorsal; being inserted into these Apophyses, by both Extremities, on one Side of the posterior cervical Ligament which separates them from those on the other. They are likewise called INTER-SPINALES.

6. TRANSVERSALES COLLI MINORES are very small and short, found in the Interstices of several transverse Apophyses, into which they are inserted. They are also called INTER-TRANSVERSALES.

USES OF THESE MUSCLES.

The particular Motions of the Cervix seem always to be accompanied with those of the Head; but there are several of these Motions in which the Head is only carried along with the first Vertebra, as if it adhered immoveably to it.

The Cervix, thus considered, may be flexed anteriorly and posteriorly, straitened, inclined to each Shoulder, and turned, as on a Pivot, by a Rotation different from that of the first Vertebra on the second.

The Scaleni, when they act on each Side at the same Time, may assist in bringing the Cervix forwards when we lean back in any Manner; when those of one Side act alone, they make a lateral Flexion, either of all the cervical Vertebrae together, as in bending the Middle of the Cervix; or of some only, as in bending the inferior Part of the Cervix alone. These lateral Flexions cannot be made indirectly with the Help of the inferior Portion of the Splenius.

The Longi Colli bring the Cervix forwards by the inferior Part of their lower Portions: When

one

one of them acts alone, or more than the other, this Motion is more or less oblique; the remaining Part of these Muscles has no Hand in these Motions, which seem to be peculiar to the last cervical Vertebra on the first dorsal.

By the superior and greatest Part of the inferior Portion they counterbalance the posterior Muscles of these Vertebrae, and hinder the Cervix from flexing posteriorly, by the Contraction of the Sterno-Mastoidæi, when, lying on the Back, we raise the Head.

It must here be remembered, that the natural Situation of the Bones of the Cervix is oblique on the anterior Part; and that the Cervix is bent in such a Manner, as that the convex Side of the Curvature lies backwards, and the concave backwards: Therefore, when we would hold the Cervix strait, and bridle it, as it is called, this Curvature must be destroyed.

This is done by these two Muscles, which, in this Case, make an Extension, in a Manner, in opposite Directions, and fix all the cervical Vertebrae close to each other, as if they were but one Bone.

The Longus Colli of one Side performs these Motions obliquely, and may likewise co-operate in the lateral Flexions of the Cervix with the Scaleri, and other Muscles, which perform these Motions, as will be shewn.

The Transversalis Major, Transversalis Gracilis, and little Transversales, acting on one Side, can have no other Use but to bend the Cervix laterally, and hinder these Flexions, when they act on both Sides. The small Transversales may likewise preserve the capsular Membranes of the Articulations from being compressed, or otherwise hurt, by the Motions of the oblique Apophyses.

The Semi-Spinales, or Transverso-Spinales, of both Sides, acting together, extend the Cervix
upon

upon the Trunk, to keep it from inclining forwards in standing or sitting, and bend it backwards. The Semi-Spinales of one Side, acting alone, produce the same Motions in an oblique Direction; and, in that Case, they are assisted by the inferior or vertebral Portion of the adjacent Splenius, under which they cross.

The Semi-Spinales of both Sides may likewise serve for the Rotation of the Cervix; but then the inferior Splenius of the opposite Side must assist them. This Motion is made, in the ordinary Situation of the Cervix, chiefly on the fourth and fifth Vertebrae; they may likewise perform the lateral Flexions of the Cervix, by assisting the Longus Colli and anterior vertebral Muscles of the same Side.

The Inter-Spinales are assistant to the Semi-Spinales in their mutual Action; and may likewise serve to bring back the Cervix to its natural Situation; after small Motions of Rotation.

The dorsal Vertebrae are moved by being bent anteriorly, by being extended or contracted, and by being inflected directly or obliquely towards each Side.

The Motion of Rotation has no Place here, because of the particular Structure of the Articulations of these Vertebrae, and their Connexion with the Ribs, which likewise hinder the Flexion backwards.

Flexion and Extension are the two principal Motions, and much more apparent than the others.



LECTURE XV.

Of the Muscles of the BACK, LOINS, and Os COCCYGIS.

THE Muscles which move the Vertebrae of the BACK and LOINS would amount to a much greater Number, and be much more difficult to conceive, than those of the NECK, were they to be reckoned separately as Vertebral or Semi-Vertebral Muscles: It is therefore proper to reduce them to a collective Number, which may, conveniently enough, be fixed to twenty-four; twelve on each Side.

I. SACRO-LUMBARIS is a long complex Muscle, narrow and thin at the superior Part, broad and thick at the inferior, representing a kind of flat Pyramid: It lies between the Spine and posterior Part of all the Ribs, and along the posterior Part of the Regio Lumbaris, all the way to the Os Sacrum.

Through all this Space it is closely accompanied by the Longissimus Dorsi, which lies between it and the spinal Apophyses of the Vertebrae, a narrow fatty or cellular Line running between them. The Name of LUMBO COSTALIS would better express the Situation of this Muscle than that of the SACRO-LUMBARIS. It might be termed MEDIUS DORSI, to distinguish it from the LATISSIMUS
and

and LONGISSIMUS DORSI, between which it is placed.

It is fixed inferiorly, by a broad, thin, tendinous Aponeurosis, to the superior Spines of the Os Sacrum, and to the adjacent lateral Parts of that Bone; and, lastly, to the external Labium of the posterior Part of the Crista Offis Ilium, all the way to the great Tuberosity. The Aponeurosis covers and adheres very closely to the inferior Part of the Longissimus Dorsi, and where it is fixed to the Os Sacrum it is a little covered by some Insertions of the Glutæus Maximus.

From thence it ascends a little laterally over all the Regio Lumbaris, the Aponeurosis sending off, from its internal Side, a Mass of musculous Fibres, which are divided, from below upwards, into several large Fasciculi inserted into all the transverse Apophyses of the Loins; afterwards, it ascends obliquely, over all the Ribs, sometimes as high as the two or three lowest cervical Vertebrae, sometimes higher, and sometimes it terminates at the first dorsal Vertebra.

Through all this Extent, that Side of the Muscle next the Longissimus Dorsi, or Vertebrae, is very even; but that next the Ribs is divided into several Portions, in an oblique Disposition, from below upwards, resembling, in some measure, the Branch of a Palm Tree: These Portions, or Digitations, are fixed in the transverse cervical Apophyses, the Tuberosity of the first Rib, the inferior Part of the angular Impressions of the ten following Ribs, and near the Extremity of the last Rib.

The Digitation belonging to the last Rib is broad, and more musculous than tendinous; those of the other Ribs are tendinous, flat, and narrow; and those of the Neck are somewhat musculous, but very slender: The most superior Portions are
longer

longer and narrower than those below them, they growing gradually shorter and broader as they descend.

In dissecting this Muscle with Care, between these Portions and the Ribs we meet with several long, thin, musculous Fasciculi, which, crossing the Portions, and adhering to them, are afterwards fixed in the Ribs above and behind the Insertions of the several Portions; and it is an easy Matter, in taking out the Diaphragm, and spreading it on a Board, to extend it too much towards both Sides.

2. *LONGISSIMUS DORSI* is very complex, long, and narrow, somewhat like the *Sacro-Lumbaris*, but more musculous and thicker, situated between the spinal Apophysis and the Muscle just mentioned; from which it is divided by a small, fatty, or cellular Line, but at the inferior Part they are confounded. It covers the *Semi-Spinalis* or *Transverso Spinalis Dorsi* and the *Semi-Spinalis Lumborum*. Its superior Part lies between the *Sacro-Lumbaris* and *Transversalis Colli*.

Its inferior Insertions are partly by distinct tendinous Portions and a broad Aponeurosis common to it with the *Sacro-Lumbaris*, and partly by large Fasciculi of musculous Fibres, which at first seem to form one uniform Mass: It is fixed, by the long, flat, tendinous Portions, of different Breadths, to the last dorsal spinal Apophysis, to all those of the Loins, and one or two of the superior Spines of the *Os Sacrum*; these Portions lie at different Distances from each other, but are all connected by a thin Aponeurosis fixed to their Margins; thence they ascend obliquely diverging from the Apophyses, and beginning to be musculous at their interior or anterior Sides, terminate above in small roundish Tendons inserted into the Extremities of the seven superior transverse dorsal

Apo-

Apophyses, and into the adjacent Ligaments of all the true Ribs.

Sometimes one Insertion into the dorsal Vertebrae is wanting, and sometimes there is one in the transverse Apophysis of the last cervical Vertebra.

The other inferior Insertion, wholly muscular, is partly in the interior or anterior Side of the Aponeurosis of the Sacro-Lumbaris, and partly in the superior Portions of the Os Sacrum, being from thence continued to the great Tuberosity of the Os Ilium, so that the Aponeurosis of the Sacro-Lumbaris seems to afford a third Insertion to the Longissimus Dorsi: Thence this uniform Mass of muscular Fibres ascends in a Course almost direct, crossing the tendinous Portions which are more oblique, and joins the inferior Fibres of the Sacro-Lumbaris by large Fasciculi inserted into the transverse and oblique Apophyses of the Vertebrae of the Loins; the Fibres of this Portion go afterwards to the Ribs, being inserted, by Planes more or less muscular, into the inferior convex Margin of all the false Ribs, between the Condyles, or Tuberosities, and the Angles.

At the sixth or seventh dorsal Vertebrae, one or more of the tendinous Portions often communicate with some Fasciculi of the Semi-Spinalis or Transverso-Spinalis Dorsi*.

This

* By this Description we see, that the Longissimus Dorsi is, in Part, a great Semi-Spinalis Divergens, or Spino-Transversalis, much in the same Manner as the inferior Portion of the Splenius.

In examining the dorsal Insertions of this Muscle we meet with several muscular Fasciculi, which cross the tendinous Portions near the Spine, but without adhering so strongly to them as those already mentioned do to the Sacro-Lumbaris, which they resemble in every other Circumstance: These Fasciculi are fixed superiorly to the transverse Apophyses of the three or four first dorsal Vertebrae, and inferiorly to those of the sixth and seventh.

This Muscle, and the *Sacro-Lumbaris*, are common to the Back and Loins.

3. *SPINALIS DORSI MAJOR* is pretty long and slender, lying upon the lateral Part of the Extremities of the dorsal spinal Apophyses: It is composed of several muscular Fasciculi of different Lengths, which, crossing each other, are inserted laterally, by small Tendons, into the spinal Apophyses, from the second, third, or fourth dorsal Vertebrae; and sometimes, tho' but seldom, from the last cervical, or first dorsal Vertebra, all the way to the first or second of the Loins, with several irregular Decussations, which vary in different Subjects.

The longest Fasciculi are a little incurvated, because they inclose the rest, which are gradually disposed between the long ones and the spinal Apophyses; so that this Muscle, which terminates, by both Extremities, in Points, is of some considerable Breadth in the Middle.

It communicates, by some Fibres, with the *Longissimus Dorsi* and *Semi-Spinalis* or *Transverso-Spinalis*, and sends off Fasciculi to several transverse dorsal Apophyses, from the fourth to the eleventh.

4. *SPINALES DORSI MINORES* are Muscles of two Kinds: Some go laterally from the Extremity

Other such Fasciculi have been met with fixed in the transverse dorsal Apophyses from the first to the ninth inclusively, and situated between the Extremities of the *Transversalis Major Colli* and of the *Longissimus Dorsi*, with which they communicate at or about the third Vertebra.

These Fasciculi might be reckoned a *Musculus Accessorius Longissimi Dorsi*, or *Transversalis Dorsi*, in the same Manner as that of the *Sacro-Lumbaris* already mentioned.

Some Anatomists imagine, that the *Longissimus Dorsi* is continued all the way to the *Apophysis Mastoidea* of the Cranium, taking the *Complexus Minor*, or *Mastoideus Lateralis*, to be a Portion of the Muscle.

of one spinal Apophysis to another, being often mixed with the short Fasciculi of the Spinalis Major; the rest lie directly between the Extremities of two adjacent spinal Apophyses, being separated from their Fellows, on the other Side, by the spinal Ligament. They are smaller and thinner than those of the Neck, and are properly enough named INTER-SPINALES.

5. TRANSVERSALIS DORSI MAJOR was described with the Longissimus Dorsi.

6. TRANSVERSALES DORSI MINORES have been found fixed to the Extremities of the three lowest transverse dorsal Apophyses; the rest are all, in some measure, Continuations of the Transversalis Major; but those few which are distinct, and lie in the Interstice between two Apophyses, may justly enough be termed INTER-TRANSVERSALES.

7. SEMI-SPINALIS, or TRANSVERSO-SPINALIS DORSI, is a musculous Mass, which, from all the spinal and transverse Apophyses of the Back and Loins, is extended, in distinct Fasciculi, over the Vertebræ themselves: It is composed, like that of the Cervix, of several oblique converging vertebral Muscles, the most superior of which is fixed, inferiorly to the third transverse dorsal Apophysis, and superiorly to the first spinal Apophysis; the lowest is fixed inferiorly to the third transverse Apophysis of the Loins, and superiorly to the last spinal dorsal Apophysis.

They may be divided into external, which are first discovered; and internal, which lie immediately on the Vertebræ. The external, from the first Vertebra to the seventh inclusively, appear to be longer than the internal, which are covered by them. They may likewise be distinguished into those which go from one transverse to several spinal Apophyses, and those which go from several transverse to one spinal Apophysis.

8. TRANS-

8. TRANSVERSO-SPINALIS LUMBORUM SACER VETERIBUS is composed of several oblique converging or transverso-spinal Muscles, in the same Manner as the Back and Neck; and it lies between the spinal and oblique Apophyses of the Loins, reaching to the Os Sacrum. The lowest of these Muscles are fixed to the superior lateral Parts of the Os Sacrum, Ligamentum Sacro-Iliacum, and to the posterior superior Spine of the Os Ilium; the rest are fixed to the three lowest transverse Apophyses and the four oblique Apophyses of the Loins, and to their lateral Tuberosities; thence they ascend to all the spinal Apophyses of these Vertebrae, the external, or those which appear first, being longer than the internal, which lie immediately on the Vertebrae especially towards the inferior Part.

9. SPINALES and TRANSVERSALES LUMBORUM are some Fasciculi which ascend from the superior false Spines of the Os Sacrum to the inferior spinal Apophyses of the Loins, which may be looked upon as so many Spinales Lumborum Majores; there are, likewise, some Spinales Minores between the spinal Apophyses of the Loins, and Transversales Minores between the transverse Apophyses, which are sometimes of a considerable Breadth.

10. QUADRATUS LUMBORUM, or LUMBARIS EXTERNUS, is small, oblong, flat, irregularly square, narrower at its superior than inferior Part, lying along the Sides of the Vertebrae Lumborum between the last false Rib and Os Ilium: It is fixed inferiorly to the external Labium of almost all the posterior Half of the Crista Ossis Ilium, Ligamentum Sacro Iliacum, and a little to the Os Sacrum, by a muscular Plane, the Fibres of which run obliquely backwards; thence it ascends between the Sacro-Lumbaris and Psoas, by both

which it is partly hid, and inserted into the Extremities of all the transverse Apophyses of the Loins by oblique tendinous Digitations; it is likewise by a broad Insertion into the twelfth Rib, on the internal Side of the Ligament that lies between it and the Longissimus Dorsi, by which that Rib is connected to the first Vertebra of the Loins.

A small Lumbaris Externus has been observed adhering very closely to the posterior Side of the Quadratus, and fixed, by tendinous Digitations, to the Extremities of the second, third, and fourth transverse Apophyses of the Loins; thence its musculous Fibres ascend obliquely over the Quadratus, and then mix with it at its Insertion into the last false Rib.

II. MUSCULI OSSIS COCCYGIS are small, thin, and radiated, lying on the internal or concave Side of the Os Sacrum and adjacent Parts of the Pelvis: They are four, two on each Side; one of which is placed more anteriorly, the other posteriorly; for which Reason, the first may be termed COCCYGÆUS ANTERIOR, or ISCHIO-COCCYGÆUS; the other COCCYGÆUS POSTERIOR, or SACRO-COCCYGÆUS.

The COCCYGÆUS ANTERIOR is fixed, by a broad Insertion, in the anterior Portion of the small transverse Ligament, at the superior Part of the Foramen Ovale of the Os Innominatum, which, as has been observed elsewhere, is no more than a particular Fold of the great transverse Ligament of the Pelvis; thence it runs between this great Ligament and the Musculus Obturator Internus (with which it is often confounded by Anatomists), contracting in Breadth. It is inserted into the inferior Part of the Os Coccygis.

The COCCYGÆUS POSTERIOR, or SACRO-COCCYGÆUS, is fixed to the internal or concave Margin of the two first Vertebrae of the Os Sacrum,

the internal and inferior Margin of the Ligamentum Sacro-Sciaticum, and to the Spine of the Os Ischium; and thence, contracting in Breadth, is inserted into the internal Side of the Os Coccygis above the former Muscle.

12. Psoas Parvus * is long and slender, lying upon the Psoas Major. This Muscle is sometimes wanting.

It is fixed, superiorly, by a short Tendon, sometimes to the last transverse dorsal Apophysis, or higher; sometimes to the first of the Loins, and sometimes to both; thence it descends entirely musculous, and more or less complex, on the great Psoas, in a Direction a little oblique. Having reached about the Middle of the Regio Lumbaris, it forms a slender flat Tendon, which, gradually increasing in Breadth like a thin Aponeurosis, runs over the Psoas Major and Iliacus Internus at their Connexion, and thence down to the Symphyses of the Os Pubis and Os Ilium; and is inserted chiefly into the Crista of the Os Pubis above the Insertion of the Pectineus, sometimes sending an aponeurotic Lamina farther down.

USES OF THESE MUSCLES.

The Flexion of the Back is not performed by any particular Muscles, but depends, both in standing and sitting, on the Relaxation of the

* RIOLAN (who often met with it in Men) observes, that he once found it in a Woman, and speaks of it as a very extraordinary Thing. We have found it oftener in Women than Men, and still continue to observe it most frequently in that Sex.

☞ Besides this Psoas Parvus, there is another, still smaller, between it and the Vertebra, inserted much in the same Manner. This Muscle was discovered by WINSLOW in the Year 1713.

Muscles, which extend or contract it, and keep it in that erect Posture. In that Case, the Weight of the Head obliges the Vertebræ to bend forwards, more or less, in Proportion to the Degree of Relaxation of the extensor Muscles.

To facilitate this Flexion, we commonly raise the Shoulders; which being done by the Action of the Serratus Major, the Rhomboïdes must be relaxed at the same Time, by which the superior Part of the Back is left at Liberty: The inferior Part is most easily bent; because the false Ribs, not being fixed by their anterior Extremities, advance forwards, sliding a little upon each other.

When we lie upon the Back or Side, this Flexion is performed chiefly by the abdominal Muscles; so that the greatest Part of the Uses of all the Muscles, belonging to the dorsal Vertebræ, is confined to Extension alone.

The two Sacro-Lumbares maintain the Back, and Regio Lumbaris, in their natural Situation, when we stand or sit; and, by the Relaxation of their Fibres more or less, the Trunk is proportionably bent forwards by the Weight of the Head and Breast: They likewise extend the Back and Loins in all Postures, keep them steady and fixed under the Weight of Burdens, and bend the Loins backwards.

One of them acting alone, may have the same Uses of bending forwards, extending, resisting, and bending posteriorly, but with less Strength, and in an oblique Direction, as when the Body is inclined obliquely forwards, and to one Side at the same Time, or extended from that Posture. They likewise serve to counter-balance the oblique Muscles of the Abdomen, in turning the Thorax upon the Pelvis, as before mentioned.

These Muscles may, in some Respects, be compared with the Splenii, that is, their superior Insertions

sertions with the mastoid Insertions of the Splenii; and their inferior Insertions with the vertebral Insertions of these Muscles.

The mastoid Portion of the Splenius is longer, more distant from the Articulation, and more disposed to perform large Motions, and resist great Efforts, than the vertebral Portion. In like Manner the costal Portion of the Sacro-Lumbaris, by the Length of the tendinous Series, their graduated Insertions into the Ribs, and their Obliquity, is better disposed, for the Uses already mentioned, than the vertebral Portion.

The small muscular Fasciculi, which cross these tendinous Portions, called Musculus Sacro-Lumbaris Accessorius, seem to counter-balance and moderate the Depression of the Ribs, in the great Efforts of the Sacro-Lumbaris.

The Use of these Muscles in progressive Motion is not sufficiently demonstrated.

It is supposed, that, while we lift one Leg, to make a Step, the Sacro-Lumbaris of the other Side sustains the lumbal and dorsal Vertebrae, to prevent their yielding to the Psoas which lifts the Leg, and puts it in Motion; but the Direction of the greatest Part of the Fibres of the Sacro-Lumbaris is very improper for such a Use.

The Use of the Sacro-Lumbaris, in Respiration, is likewise attended with Difficulties: For, when the Body is very much inclined anteriorly, and even much loaded, the Ribs continue still to be raised, with the same Ease as they are depressed, tho' the Sacro-Lumbaris is chiefly employed in this Case. But it must be observed, that we speak here only of bending and loading the Back, not of loading the Shoulders. In the first Case the Ribs move easily, but not in the second.

The Longissimus Dorsi is an Assistant to the Sacro-Lumbaris, especially to the vertebral Por-

tion of that Muscle, which it helps very powerfully, both by the Multiplicity and Insertions of its Fibres in sustaining the dorsal and lumbal Vertebrae, when extended, whether in sitting or standing; and in preventing their sinking under the Weight of the Body, or any additional Burden.

It assists in performing and counter-balancing all the Motions and Flexions which these Vertebrae, especially the lumbal, are capable of, in all Postures of the Body; and in this it likewise bears some Resemblance to the inferior or vertebral Portion of the Splenius. And it must be remembered, that these two Muscles on each Side, and the Sacro-Lumbares, are of the Number of those called *Vertebrales Obliqui Divergentes*; all the dorsal and lumbal *Spinales* and *Transversales* belonging to the Class of the *Vertebrales Recti*, the *Spinales* to the middle Muscles, and the *Transversales* to the lateral, according to the Idea given of them when we spoke of the vertebral Muscles in general.

Their chief Uses must be, to assist, moderate, and maintain, the Motions of Extension and lateral Flexion, whether simple and direct, or compound and oblique; much in the same Manner as is done by the like Muscles of the Cervix.

The *Spinales Majores*, and *Transversales Majores*, have this peculiar to them; that their muscular Portions, not lying in a strait Line between their Insertions, they may perform not only direct Motions, when they act in even Numbers; but also oblique, when the Numbers on each Side are unequal.

The small *Spinales* and *Transversales*, being confined between two adjacent Vertebrae, cannot co-operate but in direct Extensions and Flexions.

The *Semi-Spinales*, or *Transverso-Spinales*, being oblique, converging, vertebral Muscles, are

Assistants

Assistants to the Sacro-Lumbaris and Longissimus Dorsi, which they cross on each Side. By this Decussation, joined to the Multiplicity and graduated Distribution of their Insertions, they increase the Strength of the other Muscles considerably, whether they act equally and uniformly with them, or alternately.

The Lumbar Semi-Spinales, by the Antients called *MUSCULUS SACER*, because of their Insertions into the Os Sacrum, are more exposed to Motions and Strains than the dorsal; and are likewise larger and thicker.

They are much better fitted, than the Sacro-Lumbares, for supporting the Pelvis, on both Sides, in walking; and on one Side, when we raise the Foot, on that Side, and support ourselves on the other.

The *Quadratus Lumborum*, and *Psoas Parvus*, are of the same Use to the lumbar Vertebrae, as the *Scaleni* to those of the Cervix. When both *Quadrati* act, they keep the lumbar Column strait; that is, so as not to incline on either Side; and then they may assist the *Recti* of the Abdomen in the Flexions anteriorly, and the superior Portions of the *Obliqui* in lateral Flexions.

They may likewise serve to support the Haunches alternately, in walking; and, in standing on one Foot, the *Quadratus* of the opposite Side may support the Haunch of that Side: In which Action, they co-operate with the *Transverso-Spinales* and posterior Parts of the *Obliqui Abdominis*.

The *Psoas Parvus*, when it is found, serves to sustain the Pelvis, much in the same Manner with the *Musculi Recti* of the Abdomen, in climbing; &c. but when we stand, there is no Occasion for such a Support, the Pelvis resting then upon the *Os Femoris* in such a Manner, as that the largest

Portion thereof, and that which supports the whole Body, lies behind that Fulcrum, and the smallest Part before. It may likewise serve to hinder the vertebral Column from bending posteriorly, on some Occasions.

The Coccygæus Anterior may sustain the Coccyx in æquilibrio, and hinder its being bent posteriorly, and being luxated in great Strains; as the Excretion of hardened Fæces, &c.

The Coccygæus Posterior can only serve to replace the Os Coccygis when it has been forced posteriorly, and to hinder it from being luxated posteriorly.





LECTURE XVI.

Of the Muscles which move the
FEMUR on the PELVIS, and the
LEG on the OS FEMORIS.

THE Muscles which move the OS FEMORIS on the PELVIS are commonly twenty-two; sixteen of which are inserted into the FEMUR, and six move it, without being fixed to it.

Only those which are inserted into the OS FEMORIS are reckoned to belong to the THIGH, and they are commonly said to be fourteen; but we can easily demonstrate sixteen, very distinctly.

Generally the TRICEPS is reckoned but one Muscle; tho' Anatomists divide it into three; viz. PRIMUS, SECUNDUS, and TERTIUS.

There is also a small anterior and superficial Muscle, generally (tho' improperly) termed FASCIA LATA, which is a large membranous, tendinous, or ligamentary Covering, to which the greatest Part of this small Muscle is fixed; and therefore it would be more proper to call it a membranous Expansion.

The FASCIA LATA, or membranous Expansion, surrounds, more or less, all the Muscles of the THIGH: It is a muscular Ligament, very considerable, both in Extent and Strength, being chiefly composed of two Laminæ of Fibres; of which,

which, the external is more or less longitudinal, the internal more or less transverse. It is farther strengthened, in some Places, by a great Number of other Fibres, which augments its Thickness, and forms particular Expansions. The transverse Fibres are much stronger than the longitudinal.

It is fixed superiorly to the Margin of the Crista Ossis Ilium, from the large Tuberosity of the anterior superior Spine to the Ligamentum Fallopii, and to the Aponeurosis of the Obliquus Externus of the Abdomen, on which it ascends by a thin Lamina; it is likewise fixed in the lateral inferior Part of the Os Sacrum, and to the adjacent Parts of the Ligaments by which that Bone is connected to the Ossa Ilium and Ischium.

Thence it advances over the Glutæi and Thigh between the Membrana Adiposa and Muscles, all the way to the anterior and exterior Parts of the Knee. It is very thin on the Patella, but may be separated from it. It is likewise continued over the external anterior Part of the Tibia, covering the Muscles which lie there, and is strongly inserted into the Head and Crista of that Bone, and in the superior Part of the Fibula.

It sends off Elongations, which, like so many Septa, run in between the Muscles, and sometimes meet in such a Manner, as to form Vaginæ. It is strongest on the anterior and exterior Parts of the Thigh, growing gradually thinner on the interior and posterior Parts.

It is strongly inserted into the Linea Femoris Aspera between the Vastus Externus and Biceps, forming a sort of Septum between those Muscles which lie on the internal Side of the Thigh; and tho' these Vaginæ are thin, they are pretty strong, being chiefly composed of transverse Fibres.

I. PSOAS, or LUMBARIS INTERNUS, is long and thick, situated in the Abdomen on the lumbal Region,

Region, adhering to the lumbal Vertebrae from the posterior Part of the Os Ilium to the anterior near the Thigh: It is fixed superiorly to the last dorsal Vertebra, and to all the lumbal; that is, to the lateral Parts of the Bodies of these Vertebrae, and to the Roots of their transverse Apophyses.

The Insertions into the Portions of the Vertebrae are by a kind of Digitations, and are very little tendinous.

Thence the Muscle descends laterally over the Os Ilium on one Side of the iliac Muscle, and passes under the Ligamentum Fallopii between the anterior inferior Spine of the Os Ilium and that Eminence which, from its Situation, may be termed ILIO RECTINEA.

Before it goes out of the Abdomen, it connects with the Iliacus, and is sometimes fixed, by a few muscular Fibres, in the external Side of the Eminence last mentioned; it afterwards covers the anterior Side of the Head of the Os Femoris, and is inserted into the anterior Part of the Trochanter Minor by an oblique Tendon, which is folded double from behind forwards*.

2. ILIACUS is broad and thick, lying on the whole internal Side of the Os Ilium: It is fixed, by muscular Fibres, to the internal Labium of the Crista Ossis Ilium, that of the Slope between the two anterior Spines, the internal Sides of these Spines, the superior Half of the internal Side of this Bone, and to the adjacent lateral Part of the Os Sacrum. All these Fibres, contracting by Degrees, run obliquely towards the inferior Part of the Musculus Psoas, uniting therewith, and being

* This Muscle is sometimes accompanied by another smaller Muscle, almost like it, called Psoas PARVUS, which I have ranked among the lumbal Muscles, because it seldom reaches lower than the Pelvis.

fixed, by a kind of Aponeurosis, to the external Side of its Tendon all the way to the Trochanter Minor: They cover the Head of the Os Femur, and some of the lowest are inserted into that Bone a little above and behind the Trochanter Minor, and others a little lower down.

On the external Side of the inferior Extremity of the Iliacus there is sometimes a small separate Muscle fixed immediately under the anterior inferior Spine of the Os Ilium, whence it descends obliquely, joins the Iliacus, and is inserted below the Trochanter Minor: It represents, in some measure, a Roman V with the Pectineus, and might be reckoned an Iliacus Minor if the large Muscle had not sometimes an Insertion in the Side of the Protuberance called Ilio-Pectinea.

The Iliacus and Psoas, thus united, pass under the Ligamentum Fallopii over the Canal between the anterior inferior Spine of the Os Ilium and Eminentia Ilio-Pectinea, in a sort of ligamentary Capsula, very smooth, that Part of it which covers the Canal appearing like a Cartilage.

3. The PECTINÆUS is small, flat, and pretty long; broad at the superior Part, and narrow at the inferior; situated obliquely between the Os Pubis and superior Part of the Femur: It is commonly a single Muscle, but it has been sometimes found double.

It is fixed superiorly, by muscular Fibres, to all the sharp Ridge or Crista of the Os Pubis, and to a small Part of the oblong Depression, to the anterior Part of the Crista, in which the superior Extremity of this Muscle is lodged; thence it descends obliquely towards the Trochanter Minor, under and a little behind which it is inserted obliquely, by a flat Tendon, between the superior Insertion of the Vastus Internus and inferior Inser-

tion of the Triceps Secundus, to which it is connected.

4. *GLUTÆUS MAXIMUS* is thick and broad, resembling, in Shape, the Quadrant of a Circle, lying on the external Side of the Ilium and superior Part of the Femur: It is fixed, wholly musculous, to all the lateral posterior Parts of the Os Coccygis and Sacrum, to the Ligamentum Sacro-Sciaticum, the external Side of the Tuberosity of the Ilium, and thence to the external Labium of the Crista of that Bone, all the way to its highest Part, where this Muscle mixes Fibres with the *Glutæus Medius*; it is likewise fixed interiorly to the Fascia Lata, at the Places which answer to all the Insertions already mentioned, but through a much greater Space, and by a very great Number of musculous Fibres, almost in the same Manner as we have seen in the external Plane of the *Musculus Temporalis*. The Fibres which terminate in this Fascia become gradually shorter, as they are situated lower.

All these Fibres contract in Breadth, in a radiated Manner, as they approach the Trochanter Major, and afterwards form a strong, flat, pretty broad Tendon, about an Inch in Length, which is inserted, about a Finger's Breadth below the Trochanter Major, into all that large longitudinal Impression at the superior Part of the Linea Aspera on the posterior Side of the Femur, between the *Vastus Externus* and largest Portion of the Triceps.

This Tendon is covered and strengthened by a Production of the Fascia Lata, into which several fleshy Fibres of this Muscle are inserted at that Place: It is a very strong Tendon, and in this, and other Respects, bears some Resemblance to the *Deltoïdes*.

This

This Muscle covers Part of the *Glutæus Medius*, and, at its Infertion into the *Os Coccygis*, it almost joins that of the *Glutæus Maximus* of the other Side.

5. *GLUTÆUS MEDIUS* is radiated, almost in the Shape of a spread Fan, pretty thick, and almost as broad as the whole external Side of the *Os Ilium*, being situated between the *Crista* of that Name and the *Trochanter Major*; covered anteriorly by the *Fascia Lata*, and posteriorly by the *Glutæus Maximus*: It is fixed superiorly, by musculous Fibres, to all that Space on the external Side of the *Os Ilium* which lies between the external *Labium* of the *Crista* and the semi-circular Impression which goes between the superior anterior Spine and the posterior *Tinus Major*.

It is likewise fixed in the Margin of that Ligament which goes between the inferior Part of the *Os Sacrum* and *Ilium*. Lastly, The internal Part of it, which is covered only by the *Fascia Lata*, is inserted into the internal Side of that *Fascia* in the same Manner as the *Glutæus Maximus*. Thence all the Fibres contract in Breadth, more or less, in a radiated Manner, as they advance towards the *Trochanter Major*, and form a short thick Tendon which mixes, a little anteriorly, with the Tendon of the *Glutæus Minimus*; and the most posterior Fibres gradually join the Side of the Tendon of the *Pyrisiformis*.

The Tendon is inserted into the superior convex Part of the *Trochanter Major*, from the Apex of the large, superior, external, rough Surface, all the way to the anterior rough Surface; encompassing, in a Manner, all that Part of the *Trochanter*.

This is the broadest of all the *Glutæi*. The Disposition of its Fibres is not every-where uniform, the anterior Series seeming to make a distinct Portion, not by being separated from the rest,
but

but by being differently directed, for they descend almost parallel to each other; whereas the middle and posterior Portions are in a more radiated Disposition, and the anterior Portion is likewise more musculous and thick than the other two.

When this Muscle is inverted superiorly, its Tendon being first cut off from its Insertion, we see a kind of tendinous Curvature running along its whole Insertion into the semi-circular Line.

6. *GLUTÆUS MINOR* is small, broad, and radiated, situated on the external Side of the Ilium, under the other two *Glutæi*: It is fixed, superiorly, in all that Portion of the external Side of the Ilium which lies between the great semi-circular Line and another small one a little above the Supercilium of the cotyloid Cavity, or Acetabulum, running between the anterior inferior Spine and the great posterior Sinus. It is likewise fixed in the Margin of that Sinus, the Spine of the Ischium, and in the orbicular Ligament of the Articulation of the Hip; thence its Fibres, contracting in Breadth, form a short Tendon, by which the Muscle is inserted into the anterior Part of the superior Margin of the Trochanter Major above the great, external, convex, rough Surface in which the *Glutæus Medius* is fixed; and also in an oblique Surface which descends a little way between that last named and the rough anterior Surface.

The Tendon is increased in Breadth in its oblique Course inferiorly, and is likewise inserted into the orbicular Ligament chiefly by two particular tendinous Productions, or Expansions.

7. *TRICEPS PRIMUS*; with the two following tricipital Muscles, are fleshy, flat, and of different Lengths, situated between the Pubis and the whole Length of the Femur. The first and second cross each other in such a Manner, as that the Muscle
which

which is the first on the Os Pubis, becomes the second on the Os Femoris; and the second on the Pubis is the first on the Femur: The third Muscle keeps its Rank.

8. *TRICEPS PRIMUS* is fixed superiorly, by a short Tendon, to the Tuberosity on the Spine of the Pubis, and the adjacent Part of the Symphysis, its Fibres mixing a little with those of the *Pectineus*; thence it descends, increasing in Breadth, and is inserted by musculous Fibres, interiorly, into the middle Portion of the *Linea Femoris Aspera*.

At the inferior Part of this Insertion a Portion of the Muscle separates from the rest, and sends off a long Tendon, which, together with a like Tendon from the *Triceps Tertius*, is inserted into the internal Condyle of the Extremity of the Femur.

9. *TRICEPS SECUNDUS* is fixed superiorly, by musculous Fibres below the superior Insertion of the *Triceps Primus*, in all the external Side of the inferior Ramus of the Pubis, as low as the Foramen Ovale, but seldom so low as the Ramus of the Os Ischium: This Insertion is broader than that of the former Muscle. Thence it descends, and is inserted into the superior Part of the *Linea Aspera* between the *Pectineus* and *Triceps Primus*, mixing a little with each of these Muscles: This Insertion sometimes appears divided.

10. *TRICEPS TERTIUS* is fixed superiorly, by musculous Fibres, to the anterior Part of all the short Rami of the Ischium, and to a small Part of the Tuberosity of that Bone: This Insertion covers some Part of the Tendon of the *Semi-membranosus*, and is covered by that of the *Semi-nervosus*. Thence it descends, and is inserted, by musculous Fibres, into the *Linea Aspera*, almost from the *Trochanter Minor* down to the Middle
of

of the Femur. It goes lower down than the first Triceps, sending off a separate Portion like that of the last Muscle.

These two Portions unite, and form a common Tendon, which, descending to the inferior Extremity of the Femur, is inserted into the posterior Part of the Tuberosity of the internal Condyle: This separate Portion is sometimes large enough to be taken for a distinct Muscle; in which Case, we have a Quadriceps, instead of a Triceps.

In all this Progress the Muscle is united to the Vastus Internus by a perforated Aponeurosis, thro' which the sanguiferous Vessels pass.

II. PYRIFORMIS, or PYRAMIDALIS, is small and oblong, of the Figure of a flat Pear or Pyramid, whence it has its Name: It is situated almost transversely between the Os Sacrum and Ischium, being covered by the first two Glutæi; and fixed to the inferior lateral Part of the Os Sacrum by musculous Fibres, and to the circumjacent Part of the anterior or concave Side of that Bone by three Digitations lying between the anterior Foramina; it is likewise fixed, by a small Insertion, to the Ligamentum Sacro-Sciaticum and Margin of the great Sinus of the Ilium.

Thence it runs transversely towards the Articulation of the Femur, its Fibres contracting in Breadth, and terminating in a small Tendon which is inserted into the Middle of the internal Labium of the superior Margin of the Trochanter Major by two or three Rami: The superior Part of this Tendon receives several Fibres from the Glutæus Medius, and inferiorly is connected to the Gemellus Superior and Tendon of the Obturator Internus.

Sometimes there are two Pyriformes, separated by the Nervus Sciaticus.

12. **OBTURATOR INTERNUS** is flat, and almost triangular, situated at the Basis of the Pelvis: It covers the Foramen Ovale, and almost all the internal Side of the Os Pubis and Ischium. It has its Name from a Latin Verb which signifies to fill up, cover, or stop; and is fixed to the internal Labium of all the anterior Half of the Foramen Ovale a little to the adjacent Part of the Obturator Ligament, and also both above and below the Foramen: It is likewise fixed, superiorly, to the Half of the internal Side of the Os Ischium from the superior oblique Scissure in the Foramen Ovale to the superior Part of the great posterior Sinus of the Os Ilium, which would be more properly named **SINUS ILIACUS**, than **SINUS ISCHIADICUS**.

From all this Extent, the musculous Fibres, contracting in Breadth, descend below the Spine of the Ischium, where they go out of the Pelvis through the posterior Scissure of the Ischium. The internal Side of the Body of this Muscle, or that turned to the Cavity of the Pelvis, is pretty uniform; but the external, or that turned towards the Foramen Ovale, and which touches the Bone, has four middle radiated Tendons; which, uniting at the posterior Scissure of the Ischium, run over it from behind anteriorly, as over a Pulley, each Tendon sliding in a particular cartilaginous Canal already described.

Afterwards the four Tendons, having got out of the Pelvis, are very strongly united in one large flat Tendon, which, crossing over that of the Pyriformis, unites with it, having first received, on each Side, some additional musculous Fibres from the two Gemelli.

The great Tendon slides freely in a sort of membranous Vagina, formed by these Muscles, and is inserted into the Middle of the superior Part of
the

the Cavity of the Trochanter Major, adhering closely to the capsular Ligament of the Articulation, and being united to the Tendons of the Glutæus Minimus and Pyriformis.

13. GEMELLI are two small, flat, narrow Muscles, situated almost transversely, one above the other, between the Tuberosity of the Ischium and Trochanter Major, immediately below the Pyriformis, and separated by the Tendon of the Obturator Internus.

The superior and smallest GEMELLUS is fixed to the inferior Part of the Spine of the Ischium, the superior Part of the small ischiatic Scissure, and to a rough Line which crosses the external Side of the Ischium, beginning from the Spine, and continued under the Acetabulum, where it is bent inferiorly.

The inferior and largest GEMELLUS is fixed to the superior and posterior Part of the Tuberosity of the Ischium, and to a rough Impression which runs cross the external Side of the Ischium from the inferior Extremity of the ischiatic Scissure, and is bent superiorly towards the other Sinus, together with which it forms a sort of irregular Semicircle.

Both these Muscles have likewise a small Insertion into the internal Side of the Ischium, where, being connected by a particular Membrane, one of them joins the superior, and the other the inferior Side of the Obturator Internus, a little after it has passed over the Scissure. They inclose it like a Bag, and continue to be fixed to it, by muscular Fibres, quite to its Extremity.

The superior Muscle terminates wholly with the Tendon of the Obturator Internus; but the inferior, being broader, is likewise inserted, by muscular Fibres, into the orbicular Ligament, and under the Tendon of the same Obturator.

14. **OBTURATOR EXTERNUS** is small, flat, fills the Foramen Ovale of the Os Innominatum exteriorly, and reaches from the Knee to the Trochanter Major of the Femur, behind the Neck of that Bone: It is fixed, by musculous Fibres, to the anterior Side of the Pubis, all the way to the Foramen Ovale, to the Margin of that Foramen next the small Ramus of the Ischium, and a little to the adjacent Parts of the obturator Ligament.

Thence its Fibres, contracting in Breadth, pass on the anterior Side of the great Ramus of the Ischium under the Acetabulum, where a Tendon is formed, which continues its Course behind the Cervix of the Femur towards the Trochanter Major, and is inserted, between the Gemelli and Quadratus, into a small Fossula between the Apex of the Trochanter Major and Basis of the Collum Femoris.

15. **QUADRATUS** is small, flat, musculous, and of the Figure of an oblong Square; whence it has its Name: It is situated transversely between the Tuberosity of the Ischium and the Trochanter Major, and fixed, by one Extremity, along that obtuse Line which runs from under the Acetabulum towards the inferior Part of the Tuberosity of the Ischium; thence it runs directly towards the Trochanter Major, and is inserted into almost all the inferior Half of the oblong Eminence in that Apophysis, but chiefly in the small Rising or Tuberosity in the Middle of that Eminence.

16. **MUSCULUS FASCIÆ LATÆ** is small, and pretty long, situated a little obliquely superiorly and inferiorly on the anterior Part of the Femur: It is fixed superiorly to the anterior superior Spine of the Os Ilium between the Insertions of the Glutæus Medius and Sartorius; thence its musculous Fibres descend a little obliquely backwards, forming

forming a very flat Body, four Fingers Breadth in Length, and two in Breadth.

This Body lies between two Laminæ of the Fascia Lata, and is inserted therein by short tendinous Fibres, which disappear at that Place where the Fascia adheres to the Trochanter Major and Tendon of the Glutæus Maximus. We ought by no means, therefore, to look upon the Fascia as a tendinous Expansion of this Muscle.

USES OF THESE MUSCLES.

The Glutæus Major serves chiefly, by its posterior Portion, to extend the Femur, and draw it posteriorly. Neither of the two Glutæi can have this Use, tho' it is commonly attributed to all the three. By its anterior Portion it may co-operate with the rest in performing the Abduction of the Thigh, that is, in separating it from the other when we stand; but, when we sit, it can do this Office only by its posterior Portion.

By its Insertion into the Os Coccygis it may, on some Occasions, bring it anteriorly, and hinder it from being thrust too far posteriorly, as in the Excretion of hardened Fæces, or difficult Births.

The Glutæus Medius is commonly, but falsely, reckoned an Extensor of the Thigh. Its Use is, to separate one Thigh from the other when we stand, and that more or less directly, according to the Action of its anterior, posterior, or middle Portions. In this Situation, therefore, it is a true Abductor; but, by only viewing its Insertions, we may be assured, that it cannot be an Extensor.

When we sit, the only Use of this Muscle is, to perform the Rotation of the Femur about its Axis, in such a Manner, that, if the Leg be bent at the same Time, it shall be separated from the other. This Rotation is not altogether direct, but

must be more or less oblique, on account of the Crookedness of the Bone, and of the Angle which its Head makes with the Body.

The Glutæus Minimus has likewise been reckoned an Extensor of the Thigh, but without any Foundation. It assists the Glutæus Medius in the Abduction of the Thigh when we stand, and in the Rotation when we sit; therefore of these three Muscles, commonly called Extensors of the Thigh, only one deserves that Name.

What has been said of the Use of these Muscles when we stand, will equally hold in all other Situations in which the Thighs are stretched out; for instance, when we lie at full Length: And what has been said of their Uses when we sit, will agree to all other Situations in which the Thighs are bent; as when we lie with the Knees drawn up towards the Abdomen.

The Glutæi not only perform these Motions of the Thigh on the Pelvis, but reciprocally move the Pelvis on the Thighs in the same Manner. The Glutæus Maximus, for instance, not only extends the Femur, but sustains the Pelvis on the Thighs, and hinders it from being carried along with the rest of the Trunk, when the Body is inclined anteriorly while we stand; and likewise raises it, when the rest of the Body is raised.

The other two Glutæi likewise move the Pelvis on the Thigh, as they move the Thigh on the Pelvis. For instance, when we stand upon one Leg, the two Muscles on that Side draw the Pelvis laterally towards the Thigh, and hinder it from giving way or falling towards the other Side, whether the Weight of the Pelvis, itself, and of the other Leg which is not supported, endeavours to bring it.

The Psoas bends the Thigh on the Pelvis, or brings it anteriorly; it may likewise move the Pelvis

Pelvis on the Thighs, and hinders it from being carried along with the rest of the Trunk when the Body is inclined posteriorly while we sit, having the inferior Extremities fixed by some external Force. In this Situation it may likewise move the lumbal Vertebrae.

The Iliacus is a Congener, or Assistant, to the Psoas, in bringing the anteriorly and superiorly; it may likewise move the Pelvis in the same Manner with the former.

The Pectineus is an Assistant to the two former Muscles in moving the Thigh and Pelvis; it may likewise assist in bringing the Thigh inwards, or towards the other, whether it be extended, or bent, at the same Time.

The three Triceps join in the same Use, that is, to move the Thigh inwards, and bring the two Thighs near each other: As when, in riding, we press the Thighs close against the Saddle; when, in sitting, we hold any Thing close between the Knees; when we cross the Thighs; or when, in standing, we bring the Legs close together in order to jump.

The Use of these Muscles is, likewise, to hinder the Thighs from separating more than is convenient, especially in great Efforts and Jerks. This might happen, for instance, when, in mounting a Horse, or laying the Leg over a Height, we raise one Thigh hastily, and support the Body on the other. It might likewise happen by the Weight of the Body alone, when, in standing, we separate both Legs at once, or jump hastily to one Side.

This Use of bringing the Thighs together, and hindering their Separation, has Place in all possible Situations of the Body or Thigh, that is, in standing, sitting, and lying; and when bent, extended, or turned posteriorly or externally. This shews the great Necessity of providing for this

Function, not only by a strong moving Force, but also by distributing this Force in such a Manner, as that it may be able to act through almost all the Degrees of a very long Lever of one Kind.

The longest Portion of the Triceps Tertius, being inserted into the Side of the internal Condyle of the Femur, seems to counter-balance the other Portions which are inserted more posteriorly into the Linea Aspera.

These four Muscles, called likewise by the common Name of QUADRIGEMINI, are Congeners in their Uses; and these have been confined, by Anatomists, to the Rotation of the Femur about its Axis from before outwards. It has been demonstrated, many Years ago, that they cannot have this Use, except when we stand, or lie at full Length; and likewise, that in sitting, or when the Thigh is bent in any other Posture, they carry one Thigh outwards, or separate the two Thighs from each other when bent.

All the four co-operate in these two Uses of Rotation and Abduction; but they co-operate equally or unequally, according to the different Degrees of the Extension or Flexion of the Thigh. For instance, when we stand strait up, they all perform the Rotation equally; but if the Thigh be then carried a little anteriorly, the Pyriformis is more in Action than the Quadratus; and if the Thigh be carried posteriorly, the Quadratus acts most.

These Muscles, by means of their Adhesion to the orbicular Ligament of the Articulation of the Femur, may likewise serve to hinder that Ligament from being squeezed between the Bones in the different Motions of the Thigh.

The Obturator Internus has nearly the same Uses with the Quadrigemini, in making the Rotation

tation of the Thigh, when extended; and the Abduction, when bent: But the Mechanism of this Muscle is singular, in this Respect; that, by the Passage of its Tendon over the small ischiatic Scissure, it acquires a different Direction from that of the Belly or musculous Substance.

This Scissure supplies the Place of a Pulley over which a Rope is thrown, one Extremitie of which is fastened to a moveable Object; which, by pulling the other End, may be brought nearer the Pulley. In this the Pulley performs the Office of a fixed Point, or Fulcrum, with respect to the moveable Body; and, in like manner, the ischiatic Scissure is a Fulcrum for the Motion of the Thigh by the Obturator Internus.

The Obturator Externus concurs with the Internus in the same Uses, though in a more simple Manner and uniform Direction. It acts chiefly when the Thigh is extended, more or less; for, when the Thigh is bent, it only seems to cooperate with the Obturator Internus in its Action on the orbicular Ligament: Because, in other Respects, it is rather an Assistant to the Triceps, and performs the Motion of Rotation the other Way.

The Musculus Fascia Lata has been falsely supposed to be an Abductor of the Thigh; for the Direction of its moving Fibres is very contrary to such a Motion. It is very proper for making a Rotation from before inwards, that is, in a contrary Direction to that made by the Quadrigemi and Obturator Internus; and this Rotation is not so much confined as that of the Quadrigemi, because it may have Place, whether the Thigh be bent, or extended.

It may likewise assist in the great Efforts of Flexion or Adduction, provided that its different Antagonists act as Moderators, according to the dif-

different Situations of the Thigh, as will be explained elsewhere.

The six following Muscles contribute to move the Femur, without being inserted into it; viz. SARTORIUS, RECTUS, GRACILIS, RECTUS OF GRACILIS INTERNUS, SEMI-MEMBRANOSUS, SEMI-NERVOSUS, and PORTIO BICIPITIS LONGA.

All these Muscles, whether inserted into the Femur, or not, do not only move that Bone on the Pelvis, but may also move the Pelvis on the Femur.

MUSCLES WHICH MOVE THE BONES OF THE LEG ON THE FEMUR.

I. RECTUS ANTERIOR is as long as the Femur, and lies anteriorly on the Thigh, whence it has the Name of RECTUS ANTERIOR. Its greatest Portion is musculous, and the Middle is broader than the two Extremities; and terminates superiorly by a pretty strong Tendon, which is divided into two Portions, one short and strait, the other long and bent. The short Portion ascends in a strait Line, and is inserted into the anterior inferior Spines of the Ilium; the other Portion is inflected posteriorly over the Supercilium of the Acetabulum, and runs, in the Direction thereof, from the Spine towards the great ischiatic Sinus. It is strong and flat, adhering very closely to the Bone, and covered by the orbicular Ligament and Glutæus Minimus; therefore they who follow the common Method, in dissecting Bodies, often cut it off, and see only the small Portion of the Tendon.

Thence the Muscle descends entirely musculous, and partly penniform, some of its Fibres uniting superiorly, and separating below: It is narrow at the
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the superior Extremity, and becomes gradually broader towards the Middle; afterwards it contracts again in the same Manner, and, at the inferior Extremity of the Femur, terminates in a flat broad Tendon.

Through its whole Course it lies between the Vasti, covers the Crureus, and its inferior Tendon is inserted into the superior Margin of the Patella, whence it sends down a small Lamina of tendinous Fibres, which adhere very closely to the convex Side of that Bone, and, having reached the great Ligament, seem to be lost therein.

2. *VASTUS EXTERNUS* is very large, musculous, almost as long as the Femur, broad at the Extremities, and thick in the Middle, lying on the external Side of the Thigh: Its superior Insertion, being somewhat tendinous, is in the posterior or convex rough Surface of the great Trochanter; it is likewise fixed, by a musculous Insertion, externally to the Femur for above two Thirds of its Length inferiorly, in the corresponding Part of the Linea Aspera, and the adjacent Portion of the Fascia Lata.

From all this Extent the musculous Fibres descending a little obliquely forwards towards the Rectus Anterior, terminate insensibly in a kind of short Aponeurosis which is fixed in all the nearest Margin of the Tendon of the Rectus, the Side of the Petella, the Margin of the Ligament of that Bone, and in the adjacent lateral Part of the Head of the Tibia.

The Body or Belly of this Muscle grows bigger gradually from its superior Extremity to the Middle, and thence diminishes again by Degrees; its inferior Fibres run in a little behind the Rectus, and are inserted there.

3. *VASTUS INTERNUS* is much like the former, and situated, in the same Manner, on the internal
short

Side of the Femur: It is fixed superiorly, by a short flat Tendon, in the anterior rough Surface of the Trochanter Major; and, by musculous Fibres, in that oblique Line which terminates at the Basis of the Collum Femoris anteriorly, on the anterior Side of the Insertions of the Psoas and Iliacus, the whole internal Side of the Femur, and in the Linea Aspera on one Side of the Insertions of the three Tricipites, almost down to the internal Condyle.

From all this Extent the Fibres descend a little obliquely forwards, and the Body of this Muscle increases in the same Manner as the Vastus Internus, and terminates inferiorly in an Aponeurosis, which is fixed in the Margin of the Tendon of the Rectus Anterior, the Side of the Patella and its tendinous Ligament, and in the Side of the Head or superior Extremity of the Tibia.

4. CRUREUS is a musculous Mass covering almost all the anterior Side of the Femur between the Vasti, which likewise covers the Margins of this Muscle on each Side: It is fixed anteriorly to the Femur from the anterior Surface of the Trochanter Major down to the lowest Quarter of the Bone, by musculous Fibres, which descend successively over each other between the two Vasti, and are partly united to these two Muscles so as not to seem to form a distinct Muscle*.

It is not so thick as the two Vasti; and as it is covered by them on each Side, a sort of musculous Canal is formed by all the three, in which the Rectus is lodged, covering the anterior Part of the Crureus.

* As for my own Part, I ingenuously own, that I never have been able to dissect the VESTUS INTERNUS from the CRUREUS Muscles,

It terminates inferiorly in a tendinous Aponeurosis which joins the posterior Part of the Tendon of the Rectus Anterior and the adjacent Margins of the Extremities of the two Vasti; thus these four Muscles form a common Tendon, which is inserted into the Places already mentioned.

5. SARTORIUS it the longest Muscle of the human Body: It is flat, and about two Fingers in Breadth, situated obliquely along the internal Side of the Thigh; and is fixed superiorly, by a very short Tendon, in the inferior Part of the anterior superior Spine of the Ilium before the Musculus Fascia Lata. The Beginning of its Body lies in the Sciffure between the two anterior Spines of that Bone.

Thence it descends obliquely over the Vastus Internus, and other Muscles which lie under it, all the way to the internal Side of the Knee, where it terminates in a small Tendon which grows broader near its Extremity, and is inserted obliquely, and a little transversely, into the anterior Part of the internal Side of the Head of the Tibia, near the Spine or Tuberosity of that Bone, just above the Insertion of the Gracilis Interior.

The fleshy Portion of this Muscle is inclosed in a Vagina formed by an Expansion of the Fascia Lata: Its Fibres, in general, are longitudinal; and, where its inferior Extremity turns obliquely round towards the Head of the Tibia, it seems to be braced down, and secured in its Place, by a tendinous Frænum, or Vagina. A little before it is inserted, it detaches a distinct Aponeurosis, or tendinous Ramus, which descends obliquely on the internal Side of the Tibia.

6. GRACILIS INTERIOR, or RECTUS INTERIOR, is long and thin, lying, in a strait Line, on the internal Side of the Thigh, between the Os Pubis and Knee; from which Situation, and its
Structure,

Structure, the Names are taken: It is fixed, in the Margin of the inferior Portion of the Pubis, near the Symphysis, by a broad and very short Tendon, on one Side of the Insertion of the Triceps Secundus, but a little lower down; thence the muscular Fibres, contracting a little in Breadth, descend to the internal Condyle of the Femur, where they terminate in a thin Tendon, which afterwards degenerates into a kind of Aponeurosis, and is inserted anteriorly into the internal Side of the Head of the Tibia.

This Tendon is inserted immediately below the Sartorius, by which it is partly covered; and above the Semi-tendinosus, which it partly covers, mixing some Fibres with it: Before it terminates, it makes the same oblique Turn, is braced down in the same Manner as the Tendon of the Sartorius, and sends the same kind of Aponeurosis obliquely downwards on the internal Side of the Tibia.

7. BICEPS is composed of two Portions, one long, the other short; and they terminate in a common Tendon: Both Portions are muscular, and considerably thick, being situated on the posterior and external Side of the Thigh between the Buttock and Ham.

The great Portion is fixed superiorly, by a strong Tendon, in the posterior Part of the Tuberosity of the Ischium, under the Insertion of the inferior Gemellus, and close behind that of the Semi-nervosus; thence it descends towards the inferior Extremity of the Thigh, where it meets the other Portion, and joins with it in forming a common Tendon.

The small Portion is fixed, by muscular Fibres, to the external Side of the Linea Aspera below its Middle; and to the Fascia Lata, where it forms a Septum between the Triceps and Vastus

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Externus; thence the Fibres descend a little way, and, meeting the great Portion, a common Tendon is formed between them.

This strong Tendon descends to the exterior and posterior Part of the Knees, and is inserted into the lateral Ligament of the Articulation, and into the Head of the Fibula by two very short tendinous Portions. It sometimes sends off a tendinous Expansion, which is often unskilfully cut off with the Fat.

8. SEMI-NERVOSUS is long, semi-musculous, and tendinous: It is situated a little obliquely on the posterior and interior Part of the Thigh, and fixed superiorly to the posterior Part of the Tuberosity of the Ischium, immediately before and a little more internally than the Biceps. It is afterwards fixed, by muscular Fibres, to the Tendon of the Biceps for about the Breadth of three Fingers, much in the same Manner as the Coraco-Brachialis is fixed to the Biceps of the Arm; thence it descends towards the inferior Part of the internal Side of the Thigh, having a sort of tendinous Intersection in the internal Part of its muscular Portion: Having reached below the Middle of the Thigh, it terminates in a small, long, round Tendon, which descends to the internal Side of the Knee, behind that of the Gracilis, where it expands in Breadth.

It is inserted into the internal Side of the superior Part of the Tibia, about two or three Fingers Breadth below the Tuberosity or Spine, immediately under the Tendon of the Gracilis Internus, with which it communicates. It has the same oblique Turn with the Gracilis and Sartorius, and sends off a like kind of Aponeurosis.

9. SEMI-MEMBRANOSUS is long, thin, partly tendinous, whence it has its Name, and situated posteriorly on the Thigh a little towards the internal

ternal Side: It is fixed superiorly, by a broad Tendon, or long Aponeurosis, in the irregular, obtuse, prominent Line which goes from the Acetabulum to the Tuberosity of the Ischium, a little above the Insertion of the Semi-Nervosus, and between those of the Gemellus Inferior and Quadratus, mixing some Fibres with the Triceps Tertius; descending thence, it becomes musculous, in an oblique Direction, behind the internal Condyle of the Femur, below which it terminates in a thick Tendon, which is inserted into the posterior and interior Side of the internal Condyle of the Tibia, by three short Portions; the first or superior of which goes a little towards the internal Side, the second posterior, and the third inferior. Before it is inserted, it sends off, sometimes, an Aponeurosis like that of the Biceps.

10. **POPLITEUS** is small and oblique, of a pyramidal Figure, situated under the Ham, from whence it has its Name: It is fixed superiorly, by a broad narrow Tendon, to the external Margin of the internal Condyle of the Femur, and to the circumjacent posterior Part of the Articulation; thence it descends obliquely under the internal Condyle of the Femur, its flat and pretty thick musculous Body increasing in Breadth till it is fixed to the posterior Head of the Tibia all the way to the oblique Line or Impression observable on that Side.

USES OF THESE MUSCLES.

The two Vasti and Crureus ought to be looked upon as a true Triceps, the Uses of which, in relation to the Bones, are only to extend the Tibia on the Os Femoris, and the Femur on the Tibia. The Extension of the Tibia on the Os Femoris happens chiefly when we sit or lie; and that of
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the Femur on the Tibia when we stand or walk. All the three Muscles move the Patella uniformly, in the Direction of the Femur, on the Pulley at the inferior Extremity of that Bone. The external or broad Portion of this Pulley, and of the Patella, answers to this Direction, and seems to be more exposed to the Action of these Muscles than the internal and narrow Portion on which the necessary Obliquity of that Pulley depends.

The Insertion of both the Vasti immediately into the Head of the Tibia, prevents the Patella from being luxated laterally, on some Occasions, in which the Muscles may act with more Force on one Side than on the other, or remain without Action; in which Case, the Patella is loose, and floating.

To be convinced of this Action, and of the Moveableness of the Patella at the same Time, let us, either in sitting or standing with the Leg extended, rest the Leg only upon the posterior Side of the Heel so as that the whole inferior Extremity may be supported on the Heel and the Head of the Femur, the Knee and Body of the Femur resting on nothing, and the Extension being only made by the Weight of the Bones, without any Assistance from the Muscles: If, in this Situation, we lay the Thumb on the Basis of the Patella, the Fore Finger on the Apex, and press these two Parts alternately; the Patella will be perceived to be raised and depressed*.

* In an Observatiō which I made on the Insertion of several Fibres immediately into the capsular Ligament of the Articulation of the Knee, I found these Fibres descend as if they came chiefly from the Crureus; and their Insertions into the Ligament was oblique, and made by Degrees: And hence I first took the Hint of that new Species of Muscles already mentioned in describing those which surround the Articulation of the Head of the Humerus, the Ulna, and of the Femur; and, in some Articulations, the Adhesion of the Tendons, or tendinous Fibres, supplies the Place of musculous Fibres. WINSLOW.

By the Insertion of these Muscles into the Patella, their Line of Direction is removed to a greater Distance from the Center of the Axis of Motion of the Articulation, which facilitates their Action, and defends their common Tendon from Compression and Contusions.

The Rectus Anterior, by its Insertions into the Patella, is a Congener to the last three Muscles, and serves to extend the Leg. By its Insertion into the Ilium, it bends the Thigh, and assists the Psoas, Iliacus, and Pectineus, whether the Leg be extended, or bent; it likewise moves the Pelvis anteriorly on the Femur, and hinders it from falling back when we sit.

Being partly penniform, and partly simple, it is capable of sustaining great Efforts, and producing large Motions; and its Line of Direction, which is raised to a considerable Distance from the Center of Motion of the Hip and Knee, increases these Advantages. The particular Disposition and Largeness of its second superior Tendon answer principally to all the Degrees of Flexion.

The other Tendon, commonly described, would not, alone, have been sufficient for that Purpose; but its Obliquity is convenient for the Extension of the Leg when the Thigh is extended, or but little bent: But when the Thigh is very much bent, the Obliquity would remove the small Tendon to too great a Distance from the Bone, and thereby expose it to be torn off, in the same Manner as we tear off the Branch of a Tree by separating it from the Trunk. The Obliquity here mentioned is with respect to the Femur, this superior Tendon lying out of the Direction of that Bone.

The Sartorius performs the Rotation of the Thigh from before externally, whether extended, or bent; being an Antagonist to the Musculus Fascia

Fascia Lata, and a Congener to the Quadrigemini.

If, during this Rotation, the Leg is extended, the Toes are turned outwards; but if the Leg be bent, it is turned towards the other Leg: As when we lay it over the other Leg or Knee, in the same Manner that Taylors sit at work. Whence this Muscle has got its Name.

It likewise bends the Thigh, or raises it forwards: It moves the Pelvis anteriorly on the Femur; and, when the Pelvis rests on the two Tuberosities of the Ischium, in sitting, keeps it in that Situation. In this Action it is a Congener to the Rectus Anterior, but acts with much more Force, as having its Line of Direction farther from the Center of Motion.

Lastly, It bends the Leg, whether it performs the Rotation of the Thigh at the same Time, or not. In this latter Case, it is directed by the Co-operation of some Congener, or counter-balanced by the Action of the Musculus Fascia Lata.

The Length and Obliquity of its musculous Portion, the Passage of the inferior Tendon thro' the aponeurotic Vagina, the particular Insertion of this Tendon, and the Extent of the Aponeurosis which it sends over the Tibia, contribute very much to all these Uses; besides which, it may, in some Cases, assist the Poplitæus, as will be shewn.

The Gracilis Internus bends the Leg much in the same Manner with the Sartorius, which assists in this Function, but not in that of turning the Leg; and it is more proper to continue the Flexion, than begin it; it being chiefly, when the Thigh is turned by the Sartorius, that the Gracilis contributes to this Action.

It may likewise assist the Triceps in the Adduction of the Thigh, which it performs with

much more Facility than it begins the Flexion of the Leg without the Rotation of the Thigh. This Facility, in all Situations of the Thigh, is procured by the Distance of the superior Insertion of this Muscle from the Articulation of the Hip; but it cannot, with the same Ease, bend the Leg when the Thigh is not turned, for the following Reason:

While the Thigh is only extended, the Line of Direction of this whole Muscle is nearly in the same Plane with the Axis of Motion of the Knee; and therefore the Distance of its superior Insertion gives it no Advantage: But when the Thigh is turned round by the Sartorius, the Plane of its Direction changes, and crosses the Action of the Axis of the Ginglymus of the Knee, and then the lateral Distance of its superior Insertion facilitates its Action on the Leg.

The Semi-Nervosus bends the Leg, and may likewise bend the Thigh on the Leg. By its Insertion into the Tuberosity of the Ischium, it likewise extends the Thigh on the Pelvis, and carries it backwards; and may also extend the Pelvis on the Thigh when it has been inclined forwards with the rest of the Trunk, and, consequently, prevent its being carried too far along with the Trunk, when we stoop forward, either standing or sitting.

The Semi-Membranosus has the same Uses with the Semi-Nervosus. It bends the Leg on the Thigh, and the Thigh on the Leg; extends the Thigh on the Pelvis, and the Pelvis on the Thigh; and sustains the Pelvis when it is inclined anteriorly. It differs, in this one Thing, from the three Muscles last mentioned; that its Insertion is not on one Side, but behind the Articulation; and, for that Reason, it is better disposed to begin and continue the Flexion of the Leg than they are.

The two Portions of the Biceps bend the Leg on the Thigh, and the Thigh on the Leg; the superior Portion likewise extends the Thigh on the Pelvis, and the Pelvis on the Thigh. These four Uses, in general, are common to this Muscle with the Semi-Membranosus, and in some measure with the Semi-Tendinosus.

The particular Use of the Biceps, and which seems to belong more to the short Portion than the other, is to perform the Rotation of the Leg when bent, by which Motion the Toes are turned outwards, and the Heel internally. It has no Share in the Rotation of the Leg when extended, which depends entirely on that of the Thigh, the Motion of which the Leg only follows, as if these two Bones were cemented together.

The Mechanism of the Rotation of the Leg, when bent, depends chiefly on the Structure of the semi-lunar Cartilages, and the Situation of the lateral and crucial Ligaments. These Cartilages are concave on the superior Side in Proportion to the Convexity of the Condyle of the Femur; and on the inferior Side they are flattened in Proportion to the Surface of the Tibia. The lateral Ligaments are not in the Middle of each Side of the Head of the Tibia, but more posteriorly; the crucial Ligaments are disposed in such a Manner, as that when turning the Leg, when bent, from before externally, they separate; and, in turning it from before internally, they approach each other.

When the Leg is extended, or bent, the semi-lunar Cartilages perform the Office of Hinges; because the Condyles of the Femur turn in their Cavities; and, in this Case, these Cartilages may be considered as making but one Piece, in some measure, with the Tibia: And when the Leg is strongly extended, the lateral Ligaments, by their

Situation backwards, limit this Extension, and hinder the Leg from being bent forwards.

In making the two Motions of Rotation with the Leg, when bent, the semi-lunar Cartilages may be considered as being fixed to the Femur, and the Tibia slides both Ways under them. In this Case, the lateral Ligaments are very much relaxed, and no ways hinder this Rotation; and the crucial Ligaments separate when we turn the Toes outwards, the Leg being bent; but they strike against each other when the Toes are turned inwards, which serves to render the Rotation inwards more confined than the Rotation outwards.

These two reciprocal Motions of the Leg, when bent, may be compared to those of the Radius on the Ulna: The Rotation inwards answers to Pronation, and the Rotation outwards to Supination. The Biceps of the Tibia may likewise be compared to the Biceps of the Fore-Arm; both being Flexors and Rotators for Pronation and Supination, are only two Species of Rotation.

The Want of Motion in the Fibula, on these Occasions, is composed by the Moveableness of the Patella, without which the Rotation of the Leg, when bent, would be impossible: For, in making this Motion, the Patella remains perfectly at Rest on the Condyles of the Femur, the great Ligament only giving way by a sort of small reciprocal Contorsion of its inferior Extremity.

The Poplitæus performs the Rotation of the Leg, when bent, in a Direction contrary to that of the Biceps; the Biceps turns the Leg from before outwards; the Poplitæus from before inwards: This Rotation, therefore, answers to the Pronation of the Radius by the Pronator Teres, as that made by the Biceps Tibia does to the Supination made by the Biceps of the Arm.

This

This Muscle is commonly reckoned among the Flexors of the Leg; but it seems very ill contrived for such a Function, because of the Obliquity of its Situation, and its Insertion being so near the Center of Motion of the Articulation. By its Connexion with the capsular Ligament, it may serve to prevent its being caught between the two Bones in the Flexions of the Leg.





LECTURE XVII.

Of the Muscles which move the
TARSUS on the LEG, META-
TARSUS, and TOES.



HE Motions of the TARSUS are supposed to be performed by nine Muscles situated on the Leg; three anteriorly, and six posteriorly.

1. **TIBIALIS ANTICUS** is long and musculous superiorly, and tendinous inferiorly; situated anteriorly on the Leg between the **TIBIA** and **EXTENSOR DIGITORUM LONGUS**: It is fixed superiorly, by musculous Fibres, in the superior Part of the external Labium of the **Crista Tibia**, and of the internal Side of the **Aponeurosis Tibialis**, or of that ligamentary Expansion which goes between the **Crista Tibia** and anterior Part of the **Fibula**; and likewise fixed obliquely on the superior two Thirds of the external Side of the **Tibia**, or that next the **Fibula**; thence it descends, and terminates in a Tendon which first passes thro' a Ring of the common annular Ligament, and then thro' another separate Ring situated lower down; afterwards the Tendon is fixed partly in the superior and interior Part of the **Os Cuboides**, and partly in the internal Side of the metatarsal Bone.

2. *PERONÆUS MEDIUS*, called also *PERONÆUS ANTICUS*, is long, and situated anteriorly on the middle Part of the Fibula: It is fixed superiorly, by musculous Fibres, to more than the middle third Part of the anterior or external Side of the Fibula, and to the adjacent of the Aponeurosis Tibialis; it is likewise fixed to a Production from the internal Side of that Aponeurosis which runs to the superior Part of the Tibia, and there serves for a middle Septum between this Muscle and the Extensor Digitorum Longus.

Thence it descends, and forms a Tendon, which, going in the Direction of the oblique Line on the Fibula, passes behind the external Malleolus, and then thro' an annular Ligament common to it and the Peronæus Maximus, and is afterwards inserted into the Tuberosity at the Basis of the fifth metatarsal Bone, sending off a small Tendon to the first Phalanx of the Little Toe.

3. *PERONÆUS MINIMUS* is small, and commonly thought to be a Portion of the Extensor Digitorum Longus, tho' it is easily separable from it: It is fixed, by muscular Fibres, in the inferior Half of the internal Side of the Fibula, between two oblique osseous Lines on one Side of the inferior Part of the Extensor Digitorum Longus, to which Muscle it is simply contiguous.

Thence it descends, contracting in Breadth, and passes, with the Extensor Longus Digitorum, thro' the common and annular Ligament, forming a flat Tendon, which soon separates from those of the Extensor, and is inserted near the Basis of the fifth metatarsal Bone,

It is distinguished from the other two Peronæi by a Septum, or Production of the ligamentary Aponeurosis of the Tibia.

4. *GASTROCNEMII* are thick, pretty broad, and oblong, situated laterally with respect to each other, in the same Plane, under the Poples, and forming a great Part of what is called the Calf of the Leg.

That which lies next the Tibia is called *INTERNUS*, and that next the Fibula *EXTERNUS*; and form, as it were, the Belly of the Leg.

Each Muscle is fixed superiorly, by a flat Tendon, to the posterior Part of the inferior Extremity of the Femur, behind the lateral Tuberosity of each Condyle, adhering closely to the posterior Ligaments of the Articulation of the Knee.

Thence they descend, each forming a large and pretty broad musculous Body, irregularly oval. The *Externus* covers the *Poplitæus*, being larger and broader, spreading more laterally, and running lower down than the *Internus*, the musculous Body of which begins higher up than the other.

About the Middle of the Leg they terminate in a strong, broad, common Tendon, which contracts a little in Breadth as it descends, and is inserted into the posterior Extremity of the *Os Calcis*, together with the Tendon of the *Soleus*.

The superior Tendons of these Muscles become gradually cartilaginous in aged Persons, and at last ossify near the Condyles, the osseous Portions seeming like sesamoid Bones. It is sometimes very late before they are hardened in this Manner, and sometimes one grows hard before the other.

5. *SOLÆUS* is large, musculous, flat, nearly of an oval Figure, thicker in the Middle than at the Margin, and has its Name from its supposed Likeness to a Sole: It is situated, posteriorly of the Leg, lower down than the *Gastrocnemii*, by which it is covered; and these three Muscles form the Calf of the Leg.

It is fixed superiorly partly to the Tibia, and partly to the Fibula; it is also fixed to above one Third of the superior Part of the posterior Side of the Fibula, and a little to the articular Ligament of the Head of this Bone; and likewise fixed to the posterior Side of the Tibia from the oblique Line, or Impression, which terminates the Insertion of the Popliteus, down to the Middle of the internal Angle of the Bone.

Afterwards, leaving these two Bones, it terminates in a broad strong Tendon, which, together with that of the Gastrocnemii, forms what is called *TENDO ACHILLIS*. This strong Tendon contracts a little in its Passage to the Os Calcis; and then, expanding a little, it is inserted obliquely into the posterior Side of that Bone all the way to the Tuberosity. The external or posterior Fibres of this large Tendon are the longest, the internal or anterior shortest, and the rest are longer or shorter in Proportion to their Nearness to these two Portions*.

6. *TIBIALIS GRACILIS*†, called *PLANTARIS*, is small, of a pyriform Figure, situated obliquely in the Ham, below the external Condyle of the Femur between the Popliteus and Gastrocnemius Externus; and its Tendon, which is long, flat, and very small, descends on the Side of the Gastrocnemius Internus all the way to the Heel.

The muscular Substance, which is only about two Inches in Length, and one in Breadth, is

* The muscular Substance of the *SOLÆUS* seems to consist of two Laminæ of Fibres, at least; that on the posterior Side of this Muscle being the most simple, and the other, or that next the Bone, being penniform.

† This Muscle, and the two *GASTROCNEMII*, form what Anatomists call a true *TRICEPS*.

† Sometimes this Muscle is wanting, and sometimes it is situated lower down.

fixed, by a short flat Tendon, above the external Margin of the exterior Condyle of the Femur on one Side of the Gastrocnemius Externus; thence the muscular Substance descends obliquely over the Margin of the Poplitæus, and terminates in a very small, long, flat Tendon.

This Tendon runs between the Gastrocnemius Externus and Solæus, all the way to the interior Margin of the superior Part of the Tendo Achillis; and thence, continuing its Course inferiorly, it joins this Tendon, and is inserted, together with it, into the external Side of the posterior Part of the Os Calcis, without communicating with the Aponeurosis Plantaris.

7. *TIBIALIS POSTICUS* is long, muscular, penniform, broader above than below, and situated between the Tibia and Fibula, posteriorly of the Leg, and covered by the Extensor Digitorum Longus: It is fixed superiorly, by musculous Fibres, immediately under the Articulation of the Tibia and Fibula, to the nearest Parts of these two Bones, chiefly to the Tibia, reaching to the lateral Parts of that Bone above the inter-osseous Ligament which is here wanting.

Thence its Insertion is extended below the oblique Line or Impression in the Tibia, over all the adjacent Part of the inter-osseous Ligament, and thro' more than the superior Half of the internal Angle of the Fibula.

Thro' all this Space it is musculous, penniform, and covered by the Extensor Digitorum Longus, which sometimes communicates with it by a middle Tendon, and sends off an Aponeurosis to it, which does the Office of a Frænum.

After this it forms a Tendon, which descends behind the internal Malleolus thro' a cartilaginous Sinus and an annular Ligament, and, passing under the Malleolus, is inserted into the Tuberosity

or

or inferior Part of the Os Scaphoïdes. This Tendon is sometimes divided into two; one of which, crossing that of the Peronæus Longus, is fixed in the Os Cuboïdes.

8. PERONÆUS MAXIMUS, called PERONÆUS POSTERIOR, is long and penniform, lying on the Fibula: It is fixed superiorly to the anterior and exterior Part of the Head of the Fibula, and to a small Portion of the Head of the Tibia, then to the exterior Side of the Cervix of the Fibula, the superior Half of the external Angle of that Bone, and to the Aponeurosis Tibialis, which, at that Place, makes a Septum between this Muscle and the Extensor Pollicis.

Thence running a little posteriorly, according to the Direction of the Bone, it forms a considerable Tendon; which, descending behind the external Malleolus, passes thro' a kind of hollow Sinus, and an annular Ligament common to it, and to the Tendon of the Peronæus Medius which lies before it: It likewise passes thro' an annular Ligament on the external and anterior Part of the Os Calcis, and under the small lateral Tuberosity sometimes found there. Afterwards, running thro' the oblique Sinus in the inferior Side of the Os Cuboïdes, it is inserted into the Side of the Basis of the first metatarsal Bone, and also a little into the Basis of the Os Cuneiforme Majus*.

* The fleshy Portion of this Muscle cannot always be distinguished from that of the Peronæus Medius.

☞ These nine Muscles not only move the TARSUS on the LEG, but also the LEG on the TARSUS, except the TIBIALIS GRACILIS, commonly called PLANTERIS. These Motions may likewise be performed by the four following Muscles; viz. EXTENSOR POLLICIS LONGUS, EXTENSOR DIGITORUM LONGUS, FLEXOR POLLICIS LONGUS, and FLEXOR DIGITORUM LONGUS.

MUSCLES WHICH MOVE THE METATARSUS AND TOES.

1. **EXTENSOR POLLICIS LONGUS** is thin and single, lying between the *Tibialis Anticus* and *Extensor Digitorum Longus*, by which it is almost hid: It is fixed to the internal Side of the Fibula, near the inter-osseous Ligament, from the Cervix down to the lowest Quarter of that Bone, to the inter-osseous Ligament thro' the same Space, and a little to the inferior Extremity of the Tibia next the Fibula.

It terminates there in a considerable Tendon, which, passing thro' the distinct Ring of the common annular Ligament, and then thro' a membranous Vagina, is inserted into the Basis of the first Phalanx of the Great Toe, and continued thence to the second.

2. **FLEXOR POLLICIS LONGUS** is pretty long, situated in the posterior and inferior Part of the Leg: It is fixed in the inferior Half of the posterior Side of the Fibula; its Insertion reaching almost as far as the external Malleolus. The muscular Body advances, in the internal Side of that Bone, towards the Tibia, according to the oblique Direction of that Side, and terminates in a large Tendon.

This Tendon passes, behind the inferior Extremity of the Tibia, towards the internal Ankle, then thro' a small Scissure in the interior and posterior Side of the Astragalus, and thro' an annular Ligament, or ligamentary Vagina, continued under the lateral Curvature of the Calcaneum; thence it advances to the Great Toe, and, passing thro' the Interstice between the two sesamoid Bones in the ligamentary Vagina of the first Phalanx, is inserted

into the inferior Part of the second. In some Subjects this Vagina is almost cartilaginous.

The two sesamoid Bones are strongly connected by Ligaments, and also to the inferior Margin of the first Phalanx, in such a Manner, as to slide easily on the two inferior Depressions, or double Pulley, of the Head of the first metatarsal Bone: The Ligament by which they are fixed to the first Phalanx is very thick, and has the Appearance of a Cartilage as much as the Vagina.

3. THENAR is composed of several Portions, and lies on the interior Margin of the Sole of the Foot: It is fixed, by three or four musculous Fasciculi, to the inferior and interior Part of the Offa Calcis, Scaphoides, and Cuneiforme Majus; and is likewise fixed a little in the annular Ligament under the internal Ankle, which belongs to the Tendon of the Flexor Longus.

From all these different Insertions the muscular Fasciculi approach each other as they advance anteriorly under the first Bone of the Metatarsus, and are fixed partly in the internal sesamoid Bone, and partly in the internal Side of the first Phalanx, near its Basis*.

4. ANTI-THENAR is small and compound, lying obliquely under the metatarsal Bones: It is fixed posteriorly in the inferior Parts of the second, third, and fourth metatarsal Bones, near their Bases, in the Ligament belonging to the first and second of these Bones, in the adjacent Ligaments belonging to the Bones of the Tarsus; and, lastly, in a lateral Aponeurosis of the Muscle commonly called HYPO-THENAR.

* There is another Fasciculus fixed by one Extremity to the Offa Scaphoides and Cuneiforme Majus, and by the other to the external sesamoid Bone and external Side of the first Phalanx of the Great Toe.

All these Portions, contracting into a small Compass, are inserted into the exterior Side of the external sesamoid Bone and of the first Phalanx of the Great Toe.

5. *EXTENSOR DIGITORUM LONGUS* is long and muscular in the superior Part, and tendinous in the inferior, lying between the *Tibialis Anticus* and *Peronæus Maximus*: It is fixed superiorly, by musculous Fibres, in the exterior Side of the Head of the Tibia and interior Side of the Head of the Fibula; in the superior Part of the inter-ossæous Ligament, thro' three Fourths of the Length of the Fibula, and thro' the same Space in the tendinous Septum belonging to the anterior Angle of that Bone.

It seems to mix some Fibres, on each Side, with the two first *Peronæi* and *Tibialis Anticus*; and is very closely connected to the *Peronæus Minimus*; which has, for that Reason, been looked upon as a Portion of this Extensor.

It contracts in Breadth a little above the annular Ligament, and, in passing thro' it, is divided into three Tendons, the first of which is afterwards divided into two. These four Tendons are inserted along the superior or convex Side of the four small Toes.

6. *EXTENSOR DIGITORUM BREVIS* is small and complex, lying obliquely on the convex Side of the Foot, being likewise named *PEDICUS*: It is fixed in the superior and external Side of the *Os Calcis*, and in the adjacent Part of the superior Side of that Bone; thence it runs obliquely from without inwards, under the Tendons of the *Peronæus Minimus* and *Extensor Digitorum Longus*, being divided into four muscular Portions which terminate in the same Number of Tendons.

The first Tendon is inserted into the superior convex Part of the Phalanx of the Great Toe,
the

the other three, connecting with those of the Extensor Longus, are inserted along the convex Sides of all the Phalanges of the three following Toes; and when there is a fifth Tendon, which very seldom happens, it goes, in the same Manner, to the Little Toe*.

7. FLEXOR DIGITORUM BREVIS, or PERFORATUS PEDIS, is the inferior of all the common Muscles of the Toes, being situated immediately above the Aponeurosis Plantaris, which it somewhat resembles in Figure; and therefore it is very improperly named *SUBLIMIS*: It is fixed, by muscular Fibres, to the anterior and inferior Part of the great Tuberosity of the Os Calcis, and to the adjacent Part of the superior Side of the Aponeurosis Plantaris; thence it runs anteriorly, being divided into four muscular Portions, which terminate in the same Number of Tendons split at their Extremities in the same Manner as those of the *SUBLIMIS* or *PERFORATUS* of the Hand, and inserted into the second Phalanges of the four small Toes, a little nearer the internal Side than in the Hand.

8. FLEXOR DIGITORUM LONGUS, or PERFORANS PEDIS, is long and muscular superiorly, and tendinous inferiorly, lying on the posterior Side of the Leg between the Tibia and Flexor Pollicis Longus, covered by the Solæus, and covering the Tibialis Posticus: It is fixed superiorly, by muscular Fibres, to a little more than the middle third Part of the posterior Side of the Tibia, near its external Angle, below the Insertion of the

* As this Muscle is situated obliquely, its Tendon, and those of the Extensor Longus, cross each other a little, and, after their common Insertion into the first Phalanges of the Toes, those of the short Extensor run along the two other Phalanges, almost on the external Side of the others. All these Tendons communicate by Aponeuroses in the same Manner as those of the Hand.

Solæus; and also to a kind of Ligament which descends from the Middle of the Tibia; it afterwards terminates in a Tendon, which passes behind the internal Ankle on one Side, and a little behind the Tibialis Posticus, in a separate annular Ligament.

Thence it runs under the Sole of the Foot, sending off a Detachment, by which it communicates with the Flexor Pollicis Longus: There it is divided into four small flat Tendons, which go to the third Phalanges of the four small Toes in the same Manner as the Perforans of the Hand.

These four Tendons agree likewise, in this, with those of the Hand, that they give Insertions to the Lumbricales; but they differ from them in this, that, before their Separation, they are connected laterally by an auxillary muscular Substance called

9. FLEXOR DIGITORUM ACCESSORIUS, which is a flat and pretty long muscular Mass, situated obliquely under the Sole of the Foot; which, from its Situation and Figure, was formerly named *CARO PLANTÆ PEDIS QUADRATA*: It is fixed posteriorly, by one musculous Portion, in the inferior Side of the Os Calcis and anterior Tuberosity on that Side; and, by the other, in the adjacent Ligament which joins this Bone to the Astragalus.

Thence the two Portions run obliquely to the Middle of the Sole of the Foot, and there unite in a flat, long, and irregularly square muscular Mass, which is fixed to the external Margin of the Fasciculus of Tendons of the Flexor Longus, to which it serves as a Frænum at that Place.

It might more properly be named *PLANTARIS*, than that which is commonly so called, to which the Name of *TIBIALIS GRACILIS* is given.

10. LUMBRICALES are four small Muscles, situated more or less longitudinally under the Sole of the

the Foot: They are fixed, by their muscular Extremities, to the four Tendons of the Flexor Digitorum Longus, near the Insertion of the Flexor Accessorius.

The first Muscle is fixed to the internal Side of the first Tendon, the second to the tendinous Fork formed by the two first Tendons, the third to the tendinous Fork made by the second and third Tendons, and the fourth in the same Manner to the third and fourth Tendons, but commonly to the third.

Thence they run to the Toes, and terminate there in the same Number of small Tendons which are inserted into the first Phalanges of the Toes, much after the same Manner as in the Hand. They are named LUMBRICALES, or VERMICULARES, because of the Resemblance they bear to Worms.

II. TRANSVERSALIS DIGITORUM is small, and lies transversely under the Basis of the first Phalanges. At first Sight it appears to be a simple muscular Body, fixed by one Extremity to the Great Toe, and by the other to the Little one.

When this Muscle is carefully examined, we find that it is fixed, by a very short common Tendon, to the external Side of the Basis of the first Phalanx of the Great Toe, conjointly with the Anti-Thenar; and, by three different Portions or Digitations, to the three inter-osseous Ligaments which connect the Heads of the four metatarsal Bones next the Great Toe, laterally to each other. These three Portions are very slender, and gradually cover each other. It might be reckoned a second ANTI-THENAR.

12. INTER-OSSEI are seven small Muscles which fill up the four Interstices between the metatarsal Bones, much after the same Manner as in the Hand: The four largest are superior, the other

three inferior. The common Division of them into external and internal is very improper.

The first of the superior Muscles is fixed posteriorly, by muscular Fibres, in the Ligament which connects the Basis of the two first metatarsal Bones; in the external Side of the first Bone, and in the superior Part of the internal Side of the second. It terminates in a small Tendon, which is inserted into the internal Side of the first Phalanx of the Second Toe.

The other three are fixed, by musculous Fibres, in the interior and superior Parts of the last three metatarsal Bones, and in the external and superior Parts of the second, third, and fourth Bones; they likewise terminate in Tendons which are inserted into the external Side of the first Phalanges of the second, third, and fourth Toes.

The other inferior Muscles are fixed proportionably, by fleshy Fibres, to the inferior Parts of these Bones, chiefly to the third, fourth, and fifth, and to the Ligaments belonging to their Bases. The first inferior Inter osseus is likewise fixed, by some Fibres, to the Tendon of the Peronæus Maximus; the Tendons of these three Muscles are inserted into the internal Sides of the Bases of the first Phalanges of the last three Toes.

13. METATARSUS is a muscular Mass, lying under the Sole of the Foot: It is fixed, by one Extremity, in the anterior Part of the great Tuberosity of the Os Calcis; and, advancing thence, terminates in a kind of short Tendon which is fixed in the Tuberosity and posterior Part of the inferior Side of the fifth Bone of the Metatarsus.

It may move this Bone, much after the same Manner as the Metacarpus moves the fourth Bone of the Metacarpus.

14. PARA-THENAR MAJOR is pretty long, forming Part of the external Margin of the Sole of the Foot*: It is fixed posteriorly, by a muscular Body, to the external Part of the inferior Side of the Os Calcis, from the small posterior external Tuberosity all the way to the anterior Tuberosity; there it joins the Metatarsus, and at the Basis of the fifth metatarsal Bone separates from it, and forms a Tendon which is inserted into the external Side of the first Phalanx of the Little Toe near its Basis, and near the Insertion of the Muscle next following.

15. PARA-THENAR MINOR is musculous, and fixed about the posterior Half of the external and inferior Side of the fifth Bone of the Metatarsus: It terminates, under the Head of that Bone, in a Tendon which is inserted into the inferior Part of the Basis of the first Phalanx of the Little Toe.

The tendinous Insertion of this Muscle is very closely connected to the cartilaginous Ligament already mentioned: The same Thing is to be observed concerning the other Muscles which go to the inferior Parts of the Bases of the first and second Phalanges of the Toes.

In aged Persons some Parts of these Ligaments are often turned to this Bone, and thereby form those osseous Portions which are taken for distinct, sesamoid Bones, as before.

USES OF THESE MUSCLES.

The Tibialis Anticus flexes the Foot; that is, turns the Point of the Foot towards the Leg; by which Motion is performed the ginglymoid

* It is commonly termed HYPO-THENAR, but very improperly, according to the Signification of that Word.

Articulation of the Astragalus with the Tibia and Fibula: It likewise bends the Leg on the Foot, or hinders its Extension. The first of these Uses is generally known; and we have an Instance of the second every Time we stand or walk. When we stand, the Feet, being turned directly forwards, this Muscle, like a Frænum, keeps the Leg in æquilibrium, and hinders it from falling backwards. This Use is still more evident when we walk backwards.

By its lateral Insertion into the Os Cuneiforme Maximus, it moves this Bone, in particular, over the anterior Extremity of the Os Calcis; by which the Sole of the Foot is turned inwards towards the other: This lateral Situation of its Insertion is the Cause why it cannot flex the Foot directly, without the Help of the anterior Peronæi; neither can it, alone, keep the Leg in æquilibrium when we stand on one Foot.

The Peronæus Medius bends the Foot, and hinders the Leg from falling back, in the same Manner as the Tibialis Anticus. By its Insertion into the Tuberosity of the fifth metatarsal Bone, it turns the Sole of the Foot outwards at the same Time that it bends it, when it acts without the Assistance of the Tibialis Anticus, the Co-operation of which Muscle is likewise necessary, to enable it to counter-balance the Force with which the Leg would be carried backwards when we stand upon one Foot.

The Peronæus Minimus is an Assistant to the Medius in the Flexion of the Foot, preserving the Æquilibrium of the Leg, and turning the Sole of the Foot outwards; neither can it perform the first two of these Motions without the Co-operation of the Tibialis Anticus.

The uniform Flexion of the Foot furnishes an Example of all the three Kinds of Levers. Of the

the first, when we bend the Foot, while off the Ground; in which Case, the Fulcrum is in the Articulation between the two Extremities of the Lever: Of the second, when we walk upon the Heels or Toes; for then the Weight is between the Power and the Fulcrum: Of the third, when we raise a Weight by the Toes; for then the Power is between the Weight and the Fulcrum.

The *Gastrocnemii* and *Solæus* make a kind of Triceps, and, by their common Tendon, extend the Foot; and keep it extended against the strongest Resistance. It is by their means that we raise the whole Body, even with an additional Burden, when we stand a Tip-toes; and that we walk, run, and jump. The Length of the posterior Portion of the *Os Calcis* gives them a great Advantage in acting, by removing the Line of their Direction from the Axis of Motion.

The Motions of the Foot, performed by these Muscles, may be referred to the first two Kinds of Levers. When we stand a Tip-toes, the Foot represents a Lever of the second Kind, the Fulcrum being then at one End, the Power at the other, and the Weight between them; and we have a Lever of the first Kind when, the Leg being fixed, we endeavour to overcome any moveable Resistance with the Toes, or move the Foot held off the Ground.

These Muscles not only extend the Foot on the Leg, but likewise the Leg on the Foot; as appears evidently when, after a moderate Genuflexion, we raise our Bodies; for then the Foot remains fixed while these Muscles extend the Leg: But this Genuflexion is not made by the Action of any Flexors, but by the Relaxation of the proper Extensors.

The *Gastrocnemii*, by their Insertions into the Femur, may, in great Efforts, move the Leg on

the Thigh, and the Thigh on the Leg, as Assistants to the Biceps, Semi-Membranosus, Semi-Tendinosus, Gracilis Internus, and Sartorius. In these Motions the superior Extremities of the Gastrocnemii cross under the inferior Extremities of the Muscles last named. The muscular Fibres of the Gastrocnemii are very long, and there is a great Distance between their two Insertions; and, on this Account, these Muscles are better fitted for large Degrees of Motion than for Strength.

The Solæus, by the Multitude of its muscular Fibres and penniform Structure, is more proper for strong than large Motions; and seems principally to sustain the Gastrocnemii in the Motions begun by them. The tendinous Portions of this Muscle, and of the Gastrocnemii, tho' they form a strong Tendon all together, seem, nevertheless, to slide a little upon each other in the different Flexions and Extensions of the Foot.

From the Description of the Tibialis Gracilis we see, evidently, that it can have no Use with relation to the Sole of the Foot. The Use assigned to it by others, of extending the Tarsus, and thereby assisting the Gastrocnemii and Solæus, seems to me to be very uncertain, both because of the great Disproportion in its Size, and the Obliquity of its Course. If the Solæus was not covered by the Gastrocnemii, the Tibialis Gracilis might be imagined to serve as a Frænum in bracing down that Muscle, and hindering it from swelling too much; but the small Number and Direction of its Fibres would still render it unfit for that Function.

Till its true Use is evidently discovered by some lucky Observation, there is, in the mean Time, some Ground to think that it hinders the capsular Ligament of the Knee from being compressed in the Flexion of that Articulation; both because of
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its Adhesion to that Ligament, and because of the Obliquity of its Course; especially since the adjacent Portion of the same Ligament seems to receive the same Assistance from a tendinous Expansion of the Semi-Membranosus.

When the Tibialis Posticus acts alone, it extends the Foot obliquely inwards; when it acts together with the Gastrocnemii and Solæus, it changes the strait Direction of their Motion to an oblique one; when it acts with the Tibialis Anticus, the Sole of the Foot is turned more directly inwards, or towards the other Foot.

When the Peronæus Longus, or Maximus, acts alone, it may extend the Foot hanging freely in the Air; but then this Extension is obliquely outwards. Together with the Gastrocnemii and Solæus, it likewise changes their Direction to an oblique Extension outwards.

This Muscle and the Tibialis Posticus, acting without the Gastrocnemii and Solæus, may extend the Foot almost directly; but they can overcome but a very small Resistance: When it acts with the other two Peronæi, the Sole of the Foot is turned more or less directly outwards towards the external Malleolus.

The Extensor Pollicis Longus extends the two Phalanges of the Great Toe; and it may likewise be an Assistant to the Tibialis Anticus.

The Flexor Pollicis Longus not only bends the second Phalanx of the Great Toe, but may likewise serve, in great Efforts, as an Assistant to the Extensors of the Tarsus. This Muscle is of great Use in climbing up a steep Place.

The Thenar bends the first Phalanx of the Great Toe. When the Portion nearest the interior Margin of the Foot either acts alone, or acts more than the rest, the Great Toe is separated from the other Toes, especially if it be at the same Time

extended. This Separation may be greater or lesser, according to the Degrees of Action of the other Portions of the Thenar.

The Anti-Thenar, acting with the Thenar, bends the first Phalanx of the Great Toe; when it acts alone, especially if the Great Toe is bent, it brings it nearer the other Toes in Proportion to the Degrees of Action.

The two Extensores Digitorum Communes concur in extending the four small Toes; and as the Extensor Longus is not near so musculous as that of the Hand, this Difference is made up by the Extensor Digitorum Brevis. The Longus alone seems to extend the first Phalanges; and they both join in the Extension of the second and third Phalanges; the Brevis, by the Obliquity of its Direction, moderating the Action of the Longus, which otherwise would have turned the Toes obliquely the contrary Way.

The Extensor Longus may likewise assist the Tibialis Anticus and Peronæus Anticus in great Efforts, or in keeping the Foot bent; as when we would raise a Weight upon the Toes, or overcome any other Resistance. Lastly, One Extensor, alone, would not have been sufficient to counter-balance the common Flexors.

The Perforatus, or Flexor Digitorum Brevis, bends the second Phalanx; and the Perforans, or Flexor Longus, the third; the Use of these Muscles being nearly the same with those of the Perforatus and Perforans of the Hand.

The Flexor Accessorius, which might very justly be called Plantaris, is an Assistant to the Perforans, increasing its Force on some Occasions; it likewise directs the Tendon of that Muscle: For, by contracting at the same Time that the musculous Belly of the Perforans is in Action, it makes the Tendons go in a straiter Line to the Toes than they would

would otherwise do, because of their Obliquity. It has likewise another Use, with relation to the Lumbricales.

The Lumbricales have nearly the same Office in the Foot as in the Hand; and they are partly assisted, and partly directed, by the Flexor Accessorius.

The Inter-ossei of the Foot have the same Uses as in the Hand. The first superior Muscle brings the Second Toe near the Great Toe; the other three bring the Second, Third, and Fourth Toes, near the Little Toe. The three inferior Muscles move the last three Toes towards the other two. This is the Situation in which they are commonly observed; but as it varies, the Uses must likewise be different.

The Metatarsus moves the last Bone of the Metatarsus, much in the same Manner as the Metacarpus does that of the Metacarpus: By this Action it likewise draws the fourth Bone along with and contracts the Sole of the Foot, increasing the Convexity of the superior Side, provided that the Foot is not become inflexible by long wearing straight Shoes, old Age, or any other Constraint or Indisposition.

The Transversalis may assist the Metatarsus in this Action, which is supposed to be of Use to Tilers in climbing: The Anti-Thenar may likewise concur, and the Peronæus Minimus may serve to counter-balance these Muscles, and bring the Metatarsus back to its natural Situation. The common Extensors, by their nearest Tendons, may likewise be Antagonists to the Metatarsus and Transversalis.

The Para-Thenar Major serves, particularly, to separate the Little Toe from the rest; and the Para-Thenar Minor, bends the first Phalanx of that Toe. Both these Muscles seem to be too large

large and strong for the necessary Motions of so small a Part, and weak an Articulation. But as the Little Toe makes a Part of the external Margin of the Sole of the Foot, which is very much exposed to external Violence when we walk bare-footed, and no Part of it is so much exposed as the Little Toe; very powerful Muscles were necessary to strengthen it, on these Occasions.

Besides the two Uses already mentioned, the Major and Minor Para-Thenar may have another Use, in which they may likewise be assisted by the Thenar; and that is, to bend the Sole of the Foot, according to its Breadth; which Action is very requisite in walking a Tip-toes, going up a Ladder, and in climbing: On which Account, the two Para-Thenars deserve the Name of the *TILERS MUSCLES*, much better than *TRANSVERSALIS PEDIS*.

OBSERVATIONS ON THE CO-OPERATION OF MUSCLES.

We have observed, that, in order to move any Part, or keep it in a determinate Situation, all the Muscles, belonging to that Part, must co-operate; and, with respect to this Co-operation, the Muscles are distinguished into principal Movers, Moderators, or Antagonists; and Directors, or collateral Movers.

We have also taken Notice, that all these Kinds are to be found in the Articulations by Enarthrosis, and in many of those by Arthrodia; but that, in those by Ginglymus, the Director Muscles are wanting.

Lastly, That, in some Cases, the Moderators do not act; the Want of their Action being then supplied by the Weight of the Part to which they

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are fixed, or the additional Weight or Resistance of some other Body.

The Remarks which are on the Motions of Supination and Pronation furnish us with a very singular Example of the Co-operation of Muscles; and it is likewise evidently seen, in the Motions of the Scapula on the Trunk and Os Hyoides. But it is chiefly in Standing, Sitting, Progression, and the Motions of the Arm, that we observe the Co-operation of a great Number of Muscles, proportionable to the Situation of the Parts.

The Spina Dorfi and Thorax are supported, in standing, by the Co-operation of the vertebral Muscles and Longissimi Dorfi, which are here the principal Movers; of the Sacro-Lumbares, which are partly principal Movers, and partly Directors; and of the Quadrati Lumborum, which are wholly Directors.

In this Situation of the Spine, the Weight of the Thorax and Head, which naturally inclines forwards, counter-balances the Vertebrales, Longissimi Dorfi, and Sacro-Lumbares; and therefore acts in Place of Moderators.

The Head and Neck are supported in an erect Posture by the proportional Co-operation of all the Muscles which move the Head alone, or with the Neck.

The Obliqui Majores are the only ones which can be supposed to remain in Inaction while the Head is kept strait, without moving either that or the Neck.

The Splenii and Complexi are here the principal Movers, together with the Spinales and Semi-Spinales Colli. The anterior vertebral cervical Muscles are rather Assistants than Moderators, in respect of the Head; but, with regard to the Neck, they are complete Antagonists; without
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the Assistance of which, the Neck would bend forwards, and the Head fall backwards, as has been already observed.

In this Posture, the Sterno-Mastoïdæi act neither as Flexors nor Moderators of the uniform Action of the Splenii, Complexi, and posterior Vertebrales; the Action of these Muscles being counter-balanced by the Weight of the Head: Yet the Sterno-Mastoïdæus of one Side, together with the Splenius next to it, and the other Sterno-Mastoïdæus and Splenius, likewise taken together, are reciprocally principal Movers, and lateral Moderators, assisted by the Transversales and Scaleni.

When we stand in the most natural and common Posture, the Soles of the Feet are placed horizontally as the common Basis of the whole Body. To support the Legs, like immoveable Pillars, upon this Basis, the Muscles, which either cover or are fixed in them, must co-operate. The principal Movers are, the Gastrocnemii and Solæus; the Moderators are, the Tibialis Anticus, and Peronæus Medius and Minimus; and the Directors are, the Tibialis Posticus, and Peronæus Maximus.

The Legs, supported in a vertical Situation by the Co-operation of all these Muscles as by so many Ropes more or less extended, support the Ossâ Femoris, which are fixed in the proper Situation, by the Action of the two Vasti and Crureus; the Rectus Anterior being of no Use to the Os Femoris in this Situation.

The Vasti and Crureus are here the principal Movers; and they act without Moderators or Directors: For as these Bones are bent backwards, the Weight of the Body supplies the Place of very strong Antagonists.

The Thighs, in this Situation, support the Pelvis; in order to fix which, the principal Movers, Moderators, and Directors, are all employed: But these different Offices change in Proportion as we stand more or less erect. When we stand very strait, the Co-operation of all the Muscles, which can move the Pelvis on the Femur, may be looked upon as uniform, or as a kind of tonic Motion, especially the Co-operation of the Glutæi, Tricipites, Recti Anteriores, Sartorii, Semi-Nervosi, Semi-Membranosi, and of the Bicipites chiefly, when the Head is a little inclined forwards.

From what has been said about standing, we see not only an eminent Instance of the Co-operation of Muscles, but the Variety of their Uses, and the Impropriety of their common Denominations. The Gastrocnemii, Solæus, and Tibialis Posticus, are, in this Case, Extensors of the Leg, and not of the Foot; the Vasti and Crureus extend the Thigh, and not the Leg; the Recti Anteriores do not extend the Leg, nor the Sartorii bend it, but are all employed in fixing the Pelvis on the Femur.

Progression, or the Action of Walking, demonstrates still more palpably, the Co-operation of Muscles, and, at the same Time, the Variety of their Functions.

In that Case, the whole Body is alternately supported on one inferior Extremity, while the other hangs in the Air. This makes a kind of imperfect Standing, in which the Co-operation of the Muscles is much the same as in ordinary Standing, with respect to the Foot, Leg, and Thigh; but, with respect to the Pelvis, there is a considerable Difference.

To stand strait on the two Extremities, the Pelvis is only to be kept from falling backwards, and sometimes from falling forwards; but, when we stand

stand upon one Extremity, the Pelvis must not only be fixed upon the Thigh, to hinder it from falling towards the Side of the other raised Extremity; but the Spine must likewise be kept from inclining towards that Side.

The Pelvis is supported, in this Case, by a very strong Co-operation of the *Glutæus Medius* and *Minimus*, as principal Movers; and by the *Glutæus Maximus*, and *Musculus Fascia Lata*, as Assistants; and, at the same Time, the Spine is supported by the *Sacro-Lumbaris*, *Latissimus Dorsi*, and *Quadratus Lumborum*, of the same Side.

In sitting, the Pelvis rests on the two Tuberosities of the *Os Ischium*, and so cannot fall to either Side; but it must be hindered from falling either backwards or forwards; which is done by the Co-operation of the *Recti Anteriores*, *Sartorii*, *Semi-Membranosi*, *Semi-Tendinosi*, and the long Portions of the *Bicipites*: And to these might be added the *Iliaci* and *Psoai*, both ordinary and extraordinary.

These Observations are sufficient to shew the Usefulness and Necessity of being well acquainted with the Co-operation of Muscles; because, without this Knowledge, it is impossible to explain the particular Motions of some Bones, or discover or remove the Disorders or Impediments to which these Motions may be liable.

I shall only mention one Case, to shew the Importance of such Observations.

A Person complains of a Pain at the inferior Part of the *Scapula*; and that this Pain is very acute, in every Motion of Supination or Pronation, tho' he keeps the Fore-Arm bent, which is the most natural, commodious, and favourable Posture in this Case, and holds it close to his Side, by means of a Scarf, or otherwise.

If we are not acquainted with the Co-operation of the rotator Muscles and Humerus, in the ordinary Motions of Supination and Pronation, which has been explained in the Uses of the Muscles that move the Radius, we can never be able to explain or remove this Disorder.

The common Recourse, when we are without this necessary Knowledge, would be to indeterminate Ideas of some Communication between the Nerves and Vessels of the Fore-Arm and those of the Shoulder; and the Disorder would be imputed to some Obstruction in the Vessels, or Irritation or Strain of the Nerves, &c.

On this Foundation, we would order the Application of Remedies to the Parts answering to these Vessels and Nerves; and, after a Length of Time had been employed in the Cure, the true unknown Cause would either diminish, or quite disappear of itself; or perhaps increase, and thereby occasion other Disorders, of worse Consequence, nay, even such as sometimes prove mortal.

But a Person well acquainted with the muscular Co-operations, and who knows precisely how to distinguish the Muscles proper for each Co-operation, can never commit such Mistakes.





LECTURE XVIII.

ANGEIOGRAPHY of the ARTERIES.



THE HEART throws the Blood (as we have observed) into two great Arteries; one of which is named AORTA, the other ARTERIA PULMONALIS.

The AORTA distributes the Blood to all Parts of the Body, for the Function of the ANIMAL OECONOMY.

The ARTERIA PULMONALIS carries the venal Blood thro' all the capillary Vessels of the Lungs.

These two capital Arteries are subdivided into several Branches, and a Multitude of Ramifications.

The Basis of the Heart being very much inclined to the right Side, and turned a little posteriorly, the Aorta rises from it, in a direct Course, nearly opposite to the fourth dorsal Vertebra. Its Course is direct with respect to the Heart; but, to all the rest of the Body, it ascends obliquely from the left to the right Side, and from the anterior to the posterior: Soon after, it bends obliquely from the right to the left, and from before backwards, reaching as high as the second dorsal Vertebra; whence it descends again, in the same Direction, forming an oblique Curvature. The Middle of this Curvature is almost opposite to the right Side or Margin of the superior Portion of the Sternum,

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between the cartilaginous Extremities or sternal Articulations of the first two Ribs.

Thence the Aorta descends, in a direct Course, anteriorly to the Vertebra, all the way to the Os Sacrum, lying a little towards the left; and there it terminates in two subordinate or collateral Trunks, called ARTERIÆ ILIACÆ.

The Aorta is, by Anatomists, generally divided into ASCENDENS and DESCENDENS; tho' both are but one and the same Trunk. It is termed ASCENDENS from where it leaves the Heart to the Extremity of the great Curvature*; the remaining Part of this Trunk, from the Curvature to the Os Sacrum or Bifurcation already mentioned, is named DESCENDENS.

The AORTA DESCENDENS is farther divided into the superior and inferior Portions; the first taking in all that lies above the Diaphragm, the other all that lies between the Diaphragm and Bifurcation.

The AORTA ASCENDENS is chiefly distributed to Part of the Thorax, the Head, and superior Extremities. The superior Portion of the Aorta Descendens furnishes the rest of the Thorax; the inferior Portion furnishes the Abdomen and inferior Extremities.

The capital Trunk of the Aorta, through its whole Length, immediately sends off several Branches which are afterwards differently ramified; and these arterial Branches may be looked upon as so many other Trunks, with respect to the other Ramifications; which again may be considered as small Trunks, with regard to the Ramifications they send off.

* In Brutes, which have long and pendulous Necks, the AORTA divides into ASCENDENS and DESCENDENS Trunks; but in the human Species it does not divide so.

The Branches which immediately arise from the Trunk of the Aorta, may be properly called capital ones; and, of these, some are large, and others very small.

The large capital ones are these: Two ARTERIÆ SUBCLAVIÆ; two CAROTIDES; one CÆLIACA; one MESENTERICA SUPERIOR; two RENALES, formerly called EMULGENTES; one MESENTERICA INFERIOR, and two ILIACÆ CRURÆI.

The small capital ones are, chiefly, the ARTERIÆ CORONARIÆ CORDIS, BRONCHIALES, OESOPHAGÆÆ, INTERCOSTALES, DIAPHRAGMATICÆ INFERIORES, SPERMATICÆ, LUMBARES, and SACRÆ.

These capital Arteries are, for the most Part, disposed in Pairs; there being none in odd Numbers but the CÆLIACA, the two MESENTERICÆ, some of the OESOPHAGÆÆ, the BRONCHIALIS, and sometimes the SACRÆ.

The Ramifications of each capital Branch are in uneven Numbers, with respect to their particular Trunks; but, with regard to the Ramifications of the like capital Trunks on the other Side, they are disposed in Pairs. Among the Branches there are in odd Numbers none but the ARTERIA SACRA when it is single, and the OESOPHAGÆÆ, the Ramifications of which are sometimes found in Pairs.

We will now describe, in particular, all the capital or original Branches of the Aorta, from their Origin to the Entry of them and their Ramifications in all the Parts of the Body; and begin with those of the Heart.

The CARDIAC OR CORONARY ARTERIES of the Heart arise from the Aorta immediately on its leaving the Heart. They are two; and, according to the natural Situation of the Heart, one is rather superior

rior than anterior, the other rather inferior than posterior.

They egress near the two Sides of the pulmonary Artery, which having first surrounded, they afterwards run upon the Basis of the Heart in Form of a kind of Crown or Garland, whence they are called CORONARIÆ; and then pursue the superficial Traces of the Union of the two Ventricles from the Basis of the Heart to the Apex.

They send communicating Branches to each other, which are afterwards lost in the Substance of the Heart.

Sometimes a third coronary Artery is found arising from the Aorta more backwards, and is spent on the posterior or inferior Side of the Heart.

The CAROTID * ARTERIES are two; one on the right Side, the other on the left. They arise, near each other, from the Curvature of the Aorta, the left immediately, the right commonly from the Trunk of the Subclavia on the same Side, as has been said.

They run, upon each Side of the Trachea Arteria, between it and the internal jugular Vein, as high as the Larynx, without any Ramification: During this Course, therefore, they may be named carotid Trunks, or original Carotids. Each of these Trunks is afterwards ramified in the following Manner:

* Their Names are generally supposed to be derived from the Word CARAS, which signifies Sleep; because GALEN deduces that Denomination of them from ERASISTRATUS's Experiment; viz. that, upon making a Ligature on them, the Animal falls into a Carus, or Drowsiness. But, I presume, it is rather occasioned by obstructing the returning of the Blood to the Heart.

☞ There is not any other Artery in the whole human Body that runs to such a Length as the Carotids, without sending off any Rami.

The Trunk, having reached as high as the Larynx, is divided into two large Branches, or particular Carotids; one named external, the other internal; because the first goes chiefly to the external Parts of the Head, the second enters the Cranium, and is distributed to the Brain.

The external Carotid is anterior, the internal posterior; and the external is even situated more inwards, and nearer the Larynx, than the other.

The external Carotid is the smallest, and yet appears, by its Direction, to be a Continuation of the common Trunk. It runs insensibly outwards, between the external Angle of the inferior Maxilla and the parotid Gland, which it supplies as it passes; afterwards it ascends anteriorly to the Ear, and terminates in the Temples.

In this Course it sends off several Rami, which may be properly divided into anterior or internal, and posterior or external; and the principal Rami of each Kind are these.

The first anterior or internal Ramus arises from the very Origin of the Carotid; and being afterwards curved a little, and sent off Rami to the jugular Glands near it, to the Fat and Skin; it runs transversely, and is distributed to the Glandulæ Thyroïdææ, and to the Muscles and other Parts of the Larynx: For which Reason, WINSLOW names it LARYNGÆA, or GUTTURALIS SUPERIOR. It likewise sends Rami to the Pharynx, and Muscles of the Os Hyoïdes.

The second anterior Ramus passes over the nearest Cornu of the Os Hyoïdes to the Muscles of that Bone and of the Tongue; and to the Glandulæ Sublinguales: Afterwards passing before the Cornu of the Os Hyoïdes, it loses itself in the Tongue, whence it has been called ARTERIA SUBLINGUALIS; and it is the same Artery which others have named RANINA.

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The third Ramus, or *ARTERIA MAXILLARIS INFERIOR*, goes to the maxillary Gland, the styloid and mastoid Muscles, the parotid and sublingual Glands, Muscles of the Pharynx, and to the small Flexors of the Head.

The fourth Ramus, which *WINSLOW* calls *ARTERIA MAXILLARIS EXTERNA*, passes anteriorly on the masseter Muscle, and Middle of the inferior Maxilla, near the Chin; afterwards it runs under the *Musculus Triangularis Labiorum*, which it supplies, as well as the *Buccinator* and *Quadratus Menti*.

It sends off a particular Ramus, very much contorted, which divides at the angular Commissure of the Lips, and running in the same Manner along the superior and inferior Portions of the *Musculus Orbicularis*, it communicates on both Sides with its Fellow, and thereby forms a kind of *Arteria Coronaria Labiorum*.

Afterwards it ascends towards the Nares, and is distributed to the Muscles, Cartilages, and other Parts of the Nose; sending down some Twigs, which communicate with the coronary Artery of the Lips.

Lastly, It reaches the great Angle of the Eye; and is ramified and lost on the *Musculus Orbicularis Palpebrarum*, *Superciliaris*, and *Frontalis*. Thro' all this Course it is named *ARTERIA ANGULARIS*.

The fifth Ramus arises opposite to the Condyle of the inferior Maxilla; and, as it is very considerable, *WINSLOW* calls it *MAXILLARIS INTERNA*. It passes behind the Condyle; and, having given off a Twig among the *Musculi Pterygoidei*, is divided into three principal Rami.

The first Ramus goes thro' the inferior orbital or spheno-maxillary Fissure to the Orbit, after having supplied the *Musculi Peristaphylini*,

and glandulous Membrane of the posterior Nares, thro' the Foramen Spheno-Palatinum. WINSLOW names this Ramus SPHENO-MAXILLARIS.

It is distributed inferiorly and laterally to the Parts contained in the Orbit, and detaches a small subaltern Ramus thro' the Extremity of the orbitary or sphenoid Fissure; which enters the Cranium, and is spent upon the Dura Mater, communicating there with the other Artery of the Dura Mater, which enters by the Foramen Spinale of the sphenoid Bone.

It likewise sends off another subaltern Ramus, that passes thro' the posterior Opening of the orbitary Canal; and, having furnished the maxillary Sinus and Teeth, it egresses by the inferior orbitary Foramen, and on the Cheek communicates with the angular Artery.

The second of the three Rami runs thro' the Canal of the inferior Maxilla, and, being distributed to the Alveoli and Teeth, it egresses at the Foramen near the Chin, and loses itself in the adjacent Muscles, communicating with the Rami of the Arteria Maxillaris Externa.

The third Ramus of the Maxillaris Interna ascends between the internal and external Carotids, passes thro' the Foramen Spinale of the sphenoid Bone, and is distributed to the Dura Mater by several Ramifications, which run anteriorly, superiorly, and posteriorly; the superior communicating with those on the other Side above the longitudinal Sinus of the Dura Mater.

This Artery of the Dura Mater, which may be named SPHENO-SPINALIS, to distinguish it from those that go to the same Part by another Course, sometimes arises from the Trunk of the external Carotid, behind the Origin of the Laryngæa or Gutturæ Superior, and sometimes from the first Ramus

Ramus of the Maxillaris Interna, just before it enters the sphenomaxillary Fissure.

The sixth anterior or internal Ramus, which is very small, is spent on the Musculus Masseter.

The first external or posterior Ramus is named ARTERIA OCCIPITALIS: It passes obliquely before the internal jugular Vein, and, having Twigs to the Musculus Stylo-Hyoïdæus, Stylo-Glossus, and Digastricus, runs between the styloid and mastoid Apophyses, along the mastoid Sinus, and goes to the Muscles and Integuments that cover the Os Occipitis, turning several Times, in an undulating Manner, as it ascends posteriorly.

It communicates, by a descending Ramus, with the vertebral and cervical Arteries: Near the Vertex of the Head it likewise communicates with the posterior Rami of the temporal Artery, and sends a Ramus to the Foramen Mastoïdæum.

The second external Ramus spreads itself on the external Ear by a great many small Twigs on each Side, several of which run inwards, and furnish the Cartilages, Meatus Auditorius, Skin of the Tympanum, and internal Ear.

The Trunk of the external Carotid ascends afterwards above the Zygoma, passing between the Angle of the inferior Maxilla and parotid Gland, and forms the temporal Artery, which divides into an anterior, middle, and posterior Rami.

The anterior Ramus of the temporal Artery goes to the Musculus Frontalis, communicates with the Arteria Angularis, and sometimes gives off a very small Artery that pierces the internal Apophysis of the Os Malæ all the way to the Orbit. The middle Ramus goes partly to the Musculus Frontalis, partly to the Occipitalis; the posterior Ramus goes to the Occiput, and communicates with the Arteria Occipitalis: All these Rami likewise furnish the Integuments.

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The internal carotid Artery, leaving the general Trunk, is, at first, a little incurvated, appearing as if it was either the only Ramus of that Trunk, or a Ramus of the Trunk of the external Carotid: Sometimes the Curvature is turned a little externally; and then more or less internally, passing behind the adjacent external Carotid.

It is situated a little more backwards than the Carotis Externa, and generally ascends, without any Ramifications, as high as the inferior Orifice of the great Canal of the Apophysis Petrosa of the Os Temporis; enters this Orifice directly from the inferior to the superior Part, and afterwards makes an Angle according to the Direction of the Canal, the rest of which it passes horizontally, being covered by a Production of the Dura Mater.

At the Extremity of this Canal it is again incurvated from below upwards, and enters the Cranium thro' a Scissure of the sphenoid Bone; then it bends from behind anteriorly, and makes a third Angle on the Side of the Sella Sphenoïdalis, and a fourth under the clinoid Apophysis of that Sella.

As it leaves the osseous Canal to enter the Cranium, it sends off a Ramus thro' the sphenoid Fissure to the Orbit and Eye; and afterwards another thro' the Foramen Opticum, by which it communicates with the external Carotid.

Then the internal Carotid runs under the Basis of the Brain to the Side of the Infundibulum, where it is at a small Distance from the internal Carotid of the other Side, and there it commonly divides into two principal Rami, one anterior; and one posterior.

The anterior Ramus runs anteriorly under the Brain, first separating from that on the other Side; then, coming nearer again, it unites with it by an Anastomosis or Communication in the Interstice

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between the olfactory Nerves: Afterwards, having sent off some small Arteries, which accompany these Nerves, it leaves its Fellow, and divides into two or three Rami.

The first Ramus goes to the anterior Lobe of the Brain; the second, which is sometimes double, is inverted on the Corpus Callosum, to which it gives some Ramifications, as also to the Falx of the Dura Mater, and middle Lobe of the Brain: The third, which in some Subjects is a distinct Ramus, in others only a Division of the second, goes to the posterior Lobe of the Brain. This might be looked upon as a third principal Ramus lying between the other two.

The posterior Ramus communicates first with the vertebral Artery of the same Side, and then separates into several Rami which run between the superficial Circumvolutions of the Brain, and are ramified in many Directions on and between these Circumvolutions, all the way to the Basis of the Sulci.

All these Ramifications are invested by the Pia Mater, in the Duplication of which they are distributed, and form capillary reticular Textures in great Numbers; afterwards they are lost in the interior Substance of the Brain. The anterior and middle Rami produce the same kind of Ramifications; and the former, in particular, sends a Twig to the Corpus Callosum.

The SUBCLAVIAN ARTERIES, so named from their Situation near the Claviculae, in the transverse Direction, are two; one on the right, the other on the left; and arise from the Curvature of the Aorta on each Side of the left Carotid, which commonly lies in the Middle between them; but when both Carotids egress separately, they both lie between the Subclaviae. These Arteries terminate, or rather change their Name, above the

Middle of the two first Ribs, between the anterior Insertions of the Musculi Scaleni.

The right Subclavian is larger at the Beginning than the left, when it produces the right Carotid; its Origin is likewise more anterior and higher, because of the Obliquity of the Curvature of the Aorta; for which Reason, also, the left is shorter than the right, and runs more obliquely. Both of them are distributed much in the same Manner; and therefore the Description of one may likewise be applied to the other.

The right Subclavian, the longest of the two, gives off, first, small Arteries to the Mediastinum, Thymus, Pericardium, Aspera Arteria, &c. which are named *MEDIASTINÆ*, *THYMICÆ*, *PERICARDIÆ*, and *TRACHEALES*: These small Arteries sometimes egress from the Subclavian itself, either separately, or by small common Trunks; sometimes they are Rami of the *Mammaria Interna*, especially the *Mediastina*.

Afterwards this right Subclavian, at about a Finger's Breadth from its Origin, often produces the common Carotid of the same Side; and, at a small Finger's Breadth from the Carotid, it commonly gives off three considerable Rami; viz. the *MAMMARIA INTERNA*, *CERVICALIS*, and *VERTEBRALIS*; and sometimes an intercostal Artery, which goes to the first Ribs, called *INTERCOSTALIS SUPERIOR*.

The *ARTERIA THYMICA* communicates with the *Mammaria Interna*, and sometimes arises from the anterior middle Part of the common Trunk of the Subclavian and Carotid; the *THYMUS* receives likewise some Rami from the *Mammaria Interna* and *Intercostalis Superior*. The same Observation may be applied to the *MEDIASTINA* and *PERICARDIA*.

The PERICARDIA arises much in the same Manner with the Thymica, and descends upon the Pericardium quite to the Diaphragm, to which it sends some small Ramifications.

The MEDIASTINA arises sometimes immediately after the Thymica, and is distributed principally to the Mediastinum.

The TRACHEALIS, which may likewise be named GUTTURALIS INFERIOR, ascends from the Subclavia, in a winding Course, along the Aspera Arteria, to the Glandulæ Thyroidææ and Larynx, detaching small Arteries to both Sides, one of which runs to the superior Part of the Scapula.

The INTERNAL MAMMARY ARTERY comes from the anterior and inferior Side of the Subclavia, near the Middle of the Clavicula, and descends, for about a Finger's Breadth, behind the Cartilages of the true Ribs, an Inch distant from the Sternum.

In its Passage it sends Rami to the Thymus, Mediastinum, Pericardium, Pleura, and intercostal Muscles; it likewise detaches other Rami thro' these Muscles, and between the Cartilages of the Ribs, to the Pectoralis Major, and other circumjacent muscular Portions, to the Mammæ, Membrana Adiposa, and Cutis.

Several of these Rami communicate, by Anastomoses, with the Mammaria Externa, and other Arteries of the Thorax, especially in the Substance of the Pectoralis Major, and likewise with the Intercostals; afterwards it egresses from the Thorax on one Side of the Appendix Ensisformis, and is lost in the Musculus Abdominis Rectus a little below its superior Part; communicating at this Place, by several small Ramifications, with the Arteria Epigastrica; and, in its Course, it gives Rami to the Peritonæum and anterior Parts of the oblique and transverse Muscles of the Abdomen.

The

The CERVICAL ARTERY arises from the superior Side of the subclavian, and is afterwards divided into two, which egress sometimes separately, sometimes by a small common Trunk. The largest of these two Arteries is anterior, the other posterior.

The ANTERIOR CERVICALIS, running behind the Carotid of the same Side, is distributed to the Musculus Omo-Hyoïdæus, Mastoïdæus, Cutaneus, Sterno-Hyoïdæus, and Sterno-Thyroïdæus, to the jugular Glands, Aspera Arteria, Muscles of the Pharynx, Bronchia, Oesophagus, and the anterior Muscles which move the Neck and Head. This Artery has been observed to send out the Inter-costalis Superior.

The POSTERIOR CERVICALIS arises sometimes a little after the Vertebralis, and sometimes from that Artery: It passes under the transverse Apophysis of the last cervical Vertebra, and sometimes thro' a particular Foramen in that Apophysis; thence it ascends, in a winding Course, on the cervical vertebral Muscles, and then returns in the same Manner.

It communicates with a descending Ramus of the occipital Artery, and another of the vertebral Artery above the second Vertebra; is distributed to the Musculi Scaleni, Angularis Scapulæ, Trapezius, and to the jugular Glands and Integuments.

The VERTEBRAL ARTERIA egresses from the posterior and superior Side of the Subclavian, almost opposite to the Mammaria Interna and Cervicalis: It ascends thro' all the Foramina in the transverse cervical Apophyses, and, in its Passage, sends off little Twigs thro' the lateral Scissures of these Vertebrae to the Medulla Spinalis and its Coverings: It also gives Arteries to the vertebral Muscles, and to other Muscles near them.

As it passes thro' the transverse Foramen of the second Vertebra, it is generally incurvated, to accommodate itself to the particular Obliquity of this Foramen; and between this Foramen and that in the first Vertebra it takes another larger Turn, in a contrary Direction to the former: Having passed the transverse Foramen of the first Vertebra, it is considerably incurvated a third Time from before backwards, as it goes thro' the superior and posterior Sciffure in this Vertebra.

At this third Curvature it sends off a small Ramus which is ramified on the external and posterior Parts of the Occiput, and communicates with the cervical and occipital Arteries; having afterwards reached the great Foramen of the Os Occipitis, it enters the Cranium, and pierces the Dura Mater; and, on these Accounts, it may be named *ARTERIA OCCIPITALIS POSTERIOR*, to distinguish it from the other, which is lateral.

As soon as it enters the Cranium, it sends several small Ramifications to the posterior Part of the Medulla Oblongata, and to the Corpora Ovaria and Pyramidalia, which are likewise spread on the posterior Sides of the fourth Ventricle of the Brain, and form the Plexus Choroïdes of the Cerebellum.

Afterwards it advances on the Apophysis Basilaris of the Os Occipitis, inclining, by small Degrees, towards the vertebral Artery of the other Side, all the way to the Extremity of that Apophysis, where they both join in one common Trunk, which may be named *ARTERIA BASILARIS*.

This last Artery runs anteriorly under the great transverse Protuberance of the Medulla Oblongata, to which it gives Ramifications, as well as to the adjacent Parts of the Medulla. Sometimes this Artery divides again, near the Extremity of
the

the Apophysis Basilaris, into two lateral Rami, which communicate with the posterior Rami of the two internal Carotides, and are lost in the posterior Lobe of the Brain.

ARTERIÆ SPINALES are two, one anterior, the other posterior, produced by both Vertebrales; each of which, as soon as it enters the Cranium, sends out a small Ramus, by the Union of which the posterior Spinalis is formed: Afterwards the Vertebrales, advancing on the Apophysis Basilaris, or Production of the occipital Bone, detach posteriorly two other small Rami, which likewise meet, and by their Union form the Spinalis Anterior. These spinal Arteries descend on the anterior and posterior Sides of the Medulla Spinalis, and, by small transverse Ramifications, communicate with those which the intercostal and lumbal Arteries send to the same Part.

ARTERIA AUDITORIA INTERNA goes off from each Side of the Arteria Basilaris to the Organ of Hearing, accompanying the auditory Nerve, having first furnished several small Twigs to the Membrana Arachnoïdes.

ARTERIA MENINGÆA POSTERIOR arises from the same Trunk with the Auditoria Interna, and goes to the posterior Part of the Dura Mater on the occipital and temporal Bones, and likewise supplies the adjacent Lobes of the Brain.

ARTERIA INTERCOSTALIS SUPERIOR; when this Artery does not egress from the Trunk of the Aorta Descendens, it commonly arises from the inferior Side of the Subclavian, and descends on the internal Side of the two, three, or four superior true Ribs, near their Heads, and sends off, under each Rib, a Ramus which runs along the inferior Margin, and supplies the intercostal Muscles and adjacent Parts of the Pleura.

These

These Rami, or particular intercostal Arteries, communicate with each other, at different Distances, by small Ramifications, which ascend and descend from one to the other on the intercostal Muscles; they likewise give Rami to the Musculi Sterno-Hyoïdæi, Subclavius, Vertebrales, and Bodies of the Vertebrae; and also to the Pectoralis Major and Minor, piercing the intercostal Muscles: And, lastly, they send Ramifications thro' the Scissures of the first four Vertebrae to the Medulla Spinalis and its Coverings.

Sometimes the superior common intercostal Artery comes from the Cervicalis, and not immediately from the Subclavia; sometimes it arises from the Aorta Descendens, either by small separate Arteries, or a common Trunk, which separates as it ascends obliquely upon the Ribs. Lastly, it sometimes arises from the nearest Bronchialis, or from several Bronchiales together*.

ARTERIÆ BRONCHIALES sometimes go from the anterior Side of the superior descending Aorta, sometimes from the first Intercostal, and sometimes from the Arteria Oesophagææ: they likewise arise separately from each Side, to go to each Lung, and also by a small common Trunk, which afterwards separates towards the right and left Side, at the Bifurcation of the Aspera Arteria, and accompany the Ramifications of the Bronchia.

The bronchial Artery on the left Side often comes from the Aorta, while the other arises from the superior Intercostal on the same Side,

* The DUCTUS ARTERIOSUS, which is found only in the Fœtus and very young Children, arises from the Aorta Descendens immediately below the left subclavian Artery: In Adults this Duct is shrunk up and closed, and appears only like a short Ligament adhering by one Extremity to the Aorta, and by the other to the pulmonary Artery; so that, in Reality, it deserves no other Name than that of LIGAMENTUM ARTERIOSUM.

which Variety is owing to the Situation of the Aorta; sometimes there is another bronchial Artery, which egresses from the Aorta posteriorly near the superior Intercoſtal, above the Bronchialis Anterior*.

The BRONCHIALIS gives a ſmall Branch to the adjacent Auricle of the Heart, which communicates with the Arteria Coronaria.

ARTERIE OESOPHAGÆÆ are generally two or three, ſometimes but one: They ariſe anteriorly from the Aorta Descendens, and are diſtributed to the Oeſophagus, &c. ſometimes the ſuperior Oeſophagæa produces a bronchial Artery.

ARTERIE INTERCOSTALES INFERIORES are commonly ſeven or eight on each Side, and ſometimes ten, when the ſuperior Intercoſtals ariſe likewiſe from the Aorta Descendens; in which Caſe, theſe aſcend obliquely, as before.

They ariſe along the poſterior Side of the deſcending Aorta, in Pairs, to the Diaphragm, and run tranſverſly, towards each Side, on the Bodies of the Vertebrae: Thoſe on the right Side paſs behind the Vena Azygos, and afterwards they all run to the intercoſtal Muſcles along the inferior Margin of the Ribs, all the way to the Sternum, or near it.

They ſend Rami to the Pleura, vertebral Muſcles, thoſe Muſcles which lie on the external Sides of the Ribs, and to the ſuperior Portions of the Muſcles of the Abdomen; and they commu-

* In the Year 1719. Profeſſor WINSLOW obſerved a very plain Communication of the Branches of the left pulmonary Vein with the Rami of an Arteria Oeſophagæa, which came from the firſt left Intercoſtal, together with a bronchial Artery of the ſame Side.

☞ In 1719, or 1720, he diſcovered a Communication between the left bronchial Artery and Vena Azygos; and, in the Month of Auguſt 1721, ſaw a Branch of this bronchial Artery joined, by an Anafſtomosis, to the Body of the Azygos.

nicate with the Arteriæ Epigastricæ and Lumbares.

Sometimes, instead of egressing from the Aorta in Pairs, they arise by small common Trunks, which afterwards separate, and send an Artery to each adjacent Rib.

Before they take their Course along the Ribs, each of them detaches one Branch between the transverse Apophyses, on both Sides, to the vertebral Muscles, and another which enters the great Canal of the Spina Dorsi: Each of these latter Rami separates at least into two small Arteries, one of which runs transversely on the anterior Side of the Canal, the other on the posterior; each of them communicates with the like Arteries from the other Side of the Spine, in such a Manner, as to form a kind of arterial Rings, which likewise communicate with each other by other small Ramifications. The same is to be observed in the Arteriæ Lumbares.

Afterwards each intercostal Artery, having reached the Middle of the Rib, or a little more, separates into two principal Ramifications, one internal, the other external; soon after this Division, the Arteries that run upon the false Ribs separate a little from them, being gradually bent inferiorly one after another, and are spread upon the abdominal Muscles; they are likewise distributed to other adjacent Muscles, and particularly to those of the Diaphragm, almost in the same Manner with the Arteriæ Phrenicæ: They also communicate with the Lumbares, and sometimes with Rami of the Hypogastricæ.

The subclavian Artery, having left the Thorax immediately above the first Rib, in the Interstice left between the Portion of the Scalenus, there receives the Name of ARTERIA AXILLARIS, because it passes under the Axilla.

In this Course it gives off, from its internal Side, a small Branch to the interior Side of the first Rib; and afterwards four or five principal Rami; viz. the Thoracica Superior or Mammaria Externa, Thoracica Inferior, Muscularis or Scapularis Externa, Scapularis Interna, and Humeralis.

ARTERIA THORACICA SUPERIOR, or the external mammary Artery, descends, in a winding Course, on the lateral Parts of the Thorax, and crosses the Ribs: It gives Rami to the two pectoral Muscles, Mamma, Musculus Subclavius, Serratus Major, Latissimus Dorsi, and to the superior Portions of the Coraco-Brachialis and Biceps.

The Rami are sometimes separate for some Space; and one of them, in particular, descends between the Deltoïdes and Pectoralis Major, together with the Vena Cephalica, to which it adheres very closely, the Extremity of it piercing the Tunic of that Vein, as if there were an Anastomosis between them; another sometimes runs between the Musculus Brachæus and Anconæus Internus, which communicates with a Branch of the radial Artery.

ARTERIA THORACICA INFERIOR runs along the inferior Costa of the Scapula to the Musculus Subscapularis, Teres Major and Minor, Infra-Spinatus, Latissimus Dorsi, Serratus Major, and the adjacent intercostal Muscles, communicating with the Arteriæ Scapulares.

The EXTERNAL SCAPULARIS passes thro' the Scissure in the superior Costa of the Scapula, to the Musculus Supra-spinatus, Infra-spinatus, Teres Major and Minor, and to the Articulation of the Scapula with the Humerus.

The INTERNAL SCAPULARIS arises from the axillary Artery near the Axilla, and runs posteriorly, to be distributed to the Sub-scapularis, giving

ing Rami to the Serratus Major, axillary Glands, and to the Teres Major, upon which it is ramified in different Manners; it likewise sends Rami to the Infra-Spinatus and superior Portion of the Anconæi.

The HUMERAL ARTERY arises from the inferior and anterior Side of the Axillaris, and runs posteriorly between the Head of the Humerus and Teres Major, surrounding the Articulation till it reaches the posterior Part of the Deltoïdes, to which it is distributed.

During this Course, it gives several Rami to the superior Portions of the Anconæi, capsular Ligament of the Articulation of the Scapula, and to the Humerus itself, thro' several Foramina immediately below the great Tuberosity of the Head of that Bone; it likewise communicates with the scapular Artery.

Opposite to the Origin of this humeral Artery the Axillaris sends off another small Branch, that runs, in a contrary Direction, between the Head of the Humerus and the common superior Part of the Biceps and Coraco-Brachialis; and, having given Rami to the Vagina and Canal of the Biceps, and to the Periosteum, afterwards joins the principal Humeralis.

The axillary Artery, having given off these Rami, passes immediately behind the Tendon of the Pectoralis Major, where it changes its former Name for that of ARTERIA BRACHIALIS: It descends on the internal Side of the Arm over the Musculus Coraco-Brachialis and Anconæus Internus, and along the interior Margin of the Biceps behind the Vena Basilica, giving small Rami, on both Sides, to the adjacent Muscles, Periosteum, and the Bone.

Between the Axilla and Middle of the Arm it is covered only by the Skin and Fat, but after-

wards hid under the Biceps, and runs obliquely forwards as it descends, being at some Distance from the internal Condyle ; but it does not reach the Middle of the Fold of the Arm.

Between the Axilla and this Place it sends off many Rami to the Infra-Spinatus, Teres Major and Minor, Sub-scapularis, Latissimus Dorsi, Serratus Major, and other adjacent Muscles, to the common Integuments, and even to the Nerves. Below the Fold of the Arm it separates into two principal Rami, one called *ARTERIA CUBITALIS*, the other *RADIALIS*.

From its superior and interior Part it sends off a particular Ramus, which descends obliquely and posteriorly over the Anconæi, and then turns anteriorly again near the external Condyle, where it communicates with a Ramus of the *Arteria Radialis*.

Immediately below the Insertion of the Teres Major it gives off another Ramus, which runs from within externally, and from behind anteriorly, round the Humerus ; and descends obliquely forwards between the *Musculus Brachæus* and *Anconæus Externus*, to both which it is distributed, in its Passage : Having afterwards reached the external Condyle, it unites with the Branch last mentioned, and likewise communicates with a Branch of the Arteries of the Fore-Arm, so that there is here a triple Anastomosis.

About a Finger's Breadth below this second Ramus the brachial Artery sends off a third, which descends towards the internal Condyle, and communicates with other Rami of the Arteries of the Fore-Arm.

About the Middle of the Arm, or a little lower, much about the Place where the brachial Artery begins to be covered by the Biceps, it sends off a Branch,

Branch, which is distributed to the Periosteum, and penetrates the Bone between the Musculus Brachiaëus and Anconæus Internus.

About an Inch lower it gives off another Branch, which, having furnished Ramifications to the Anconæus Internus, runs over the internal Condyle, and likewise communicates with Rami of the Arteries of the Fore-Arm: Having got below the Middle of the Arm, the brachial Artery detaches another Ramus which runs behind the internal Condyle, in Company with a considerable Nerve; and, having passed over the Muscles inserted into this Condyle, it communicates with that Branch of the cubital Artery which encompasses the Fold of the Arm.

A little lower it sometimes sends out another Ramus which passes on the anterior Side of the internal Condyle, and then communicates with a Branch that ascends from the cubital Artery: These three communicating Rami are called collateral Arteries.

The common Trunk of the brachial Artery, having reached the Fold of the Arm, runs, together with a Vein and a Nerve, immediately under the Aponeurosis of the Biceps, and passes under the Vena Mediana, detaching Rami, on each Side, to the circumjacent Muscles*.

About a large Finger's Breadth beyond the Fold of the Arm, this Artery separates into two principal Rami; one interior or posterior, named Cubitalis;

* In some Subjects, on whom the cubital Branch, in lieu of slipping behind the Musculus Rotundus, as it commonly does before this Muscle, is so superficial, that it may easily be mistaken for a Vein: Wherefore we ought always to be upon our Guard, when we bleed any Person, to examine, before we apply the Ligature to the Arm, the Pulsations of the Artery. See this Division in my first Anatomical Table.

the other exterior or anterior, named Radialis; as before*.

The CUBITAL ARTERY sinks in between the Ulna and superior Parts of the Pronator Teres, Perforatus, Ulnaris Gracilis, and Radialis Internus; then, leaving the Bone, it descends between the Perforatus and Ulnaris Internus to the Carpus and great transverse Ligament: In this Course it turns and winds several Ways, sending Rami.

The first is a small Artery that runs inwards to the internal Condyle, and then turns superiorly, like a kind of Recurrent, to communicate, by several Rami, with the collateral Arteries of the Arm already mentioned, and particularly with the third; a little lower down another small Branch goes off, which, having ascended a little way, and almost surrounded the Articulation, communicates with the second collateral Artery of the Arm, between the Olecranon and interior Condyle.

Afterwards the cubital Artery having, in its Course between the Heads of the Ulna and Radius, reached the inter-osseous Ligament, sends off two principal Rami, one internal, the other external; which WINSLOW calls the inter-osseous Arteries of the Fore-Arm.

The external Artery pierces the Ligament about three Fingers Breadth below the Articulation, and immediately afterwards gives off a Branch, which ascends, like a Recurrent, towards the external Condyle of the Humerus under the Ulnaris Externus and Anconæus Minimus, to which it is

* From this Bifurcation the brachial Artery sends Branches, on each Side, to the Supinator Longus, Pronator Teres, Fat, and Skin. It sometimes happens, tho' very rarely, that this Artery is divided, from its Origin, into two large Branches, which descend on the Arm, and afterwards on the Fore-Arm, where they have the Names of Cubitalis and Radialis.

distributed, as also to the Supinator Brevis; and it communicates with the collateral Arteries of the Arm on the same Side.

Afterwards this external inter-osseous Artery descends on the external Side of the Ligament, and is distributed to the Ulnaris Externus, Extensor Digitorum Communis, add to the Extensores Pollicis, Indicis, and Minimi Digiti; communicating with some Rami of the internal inter-osseous Artery.

Having reached the inferior Extremity of the Ulna, it unites with a Branch of the internal inter-osseous Artery, which at this Place runs from within externally, and is distributed, together with it, on the convex Side of the Carpus and Back of the Hand; communicating with the Arteria Radialis and a Branch of the Cubitalis.

By these Communications this Artery forms a sort of irregular Curvature, whence Rami are detached to the external inter-osseous Muscles, and to the external lateral Parts of the Fingers.

The internal inter-osseous Artery descends very close to the Ligament, till it reaches below the Pronator Teres, between which and the Pronator Quadratus it perforates the Ligament, and goes to the convex Side of the Carpus and Back of the Hand, where it communicates with the external inter-osseous Artery, Radialis, and internal Rami of the Cubitalis.

From the Origin of the two Inter-osseæ the cubital Artery descends between the Perforatus, Perforans, and Ulnaris Internus, along the Ulna, sending Rami to the adjacent Parts; below the internal Inter-ossea it sometimes sends off a Branch which descends between the Flexor Pollicis, Radialis Internus, and Perforatus, to which it is distributed, and continues to the Carpus, where it runs
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under the internal annular Ligament, and communicates on the Hand with Rami of the Arteria Radialis.

Afterwards the cubital Artery passes over the internal transverse Ligament of the Carpus, by the Side of the Os Pisiforme; and, having furnished the Skin, Palmaris Brevis, and Metacarpus, it slips under the Aponeurosis Palmaris, giving off one Branch to the Hypo-Thenar, Minimi Digiti, and another which runs towards the Thumb between the Tendons of the Flexors of the Fingers and the Bases of the metacarpal Bones.

It likewise sends off a Branch, which, running between the third and fourth Bones of the Metacarpus, reaches to the Back of the Hand, where it communicates with the external inter-osseous Artery; afterwards, having supplied the inter-osseous Muscles, it communicates with the Radialis; and they both form an arterial Curvature in the Hollow of the Hand as follows:

The Cubitalis, having got about two Fingers Breadth beyond the internal annular Ligament of the Carpus, forms a Curvature, the convex Side of which is turned to the Fingers, and commonly sends off three or four Rami. The first goes to the internal and posterior Part of the Little Finger, and is sometimes a Continuation or Production of that Branch which goes to the Hypo-Thenar; the other three Rami run in the Interstices of the four metacarpal Bones, near the Heads of which each of them is divided into two Rami, which pass along the two internal lateral Parts of each Finger, from the anterior Side of the Little Finger to the posterior Side of the Index inclusively; and at the Ends of the Fingers these digital Arteries communicate and unite with each other.

Some-

Sometimes the Curvature of the cubital Artery terminates, by a particular Branch, in the Middle Finger; and, in that Case, it communicates with the radial Artery, which makes up what the other wants.

This Curvature sends likewise from its concave Side, towards the second Phalanx of the Thumb, a Branch for the lateral internal Part thereof, and then terminates, near the Head of the first metacarpal Bone, by a Communication with the Radialis, having first given a Branch to the anterior Side of the Index, and another to the Side of the Thumb next the former: These communicate, at the Ends of the Fingers, with the adjacent Rami, as in the other Fingers.

This Curvature likewise sends small Twigs to the inter-ossæous Muscles, Lumbricales, Palmaris, and other adjacent Parts; and, lastly, to the Integuments.

The RADIAL ARTERY begins by detaching a small Branch, which ascends, like a Recurrent, towards the Fold of the Arm, and turns backwards round the external Condyle, communicating with the adjacent Rami from the Trunk of the brachial Artery, especially the first collateral Branch on that Side.

It descends, along the internal Side of the Radius, between the Supinator Longus, Pronator Teres, and the Integuments, giving Rami to these Muscles, and likewise to the Perforatus, Perforans, and Supinator Brevis; thence it runs, in a winding Course, towards the Extremity of the Radius, supplying the Flexors of the Thumb and Pronator Quadratus.

Having reached the Extremity of the Radius, it runs nearer the Skin, especially towards the anterior Margin of the Bone, being the Artery which we there feel when we examine the Pulse.

At the End of the Radius it gives off a Branch to the Thenar; and, after having communicated with the Curvature of the cubital Artery in the Palm of the Hand, and sent off some cutaneous Rami at that Place, it detaches one along the whole internal lateral Part of the Thumb.

Afterwards it runs between the first Phalanx and Tendons of the Thumb to the Interstice between the Basis of this first Phalanx and of the first metacarpal Bone, where it turns towards the Hollow of the Hand.

At this Turning it sends off a Branch to the external lateral Part of the Thumb, which, having reached the End thereof, communicates, by a small Curvature, with the Branch that goes to the internal lateral Part.

It likewise sends Rami externally, which run more or less transversly between the first two Bones of the Metacarpus and the two Tendons of the Radialis Externus; and communicates with an opposite Branch of the Cubitalis, together with which it furnishes the external inter-osseous Muscles and Integuments of the Back of the Hand and convex Side of the Carpus.

Lastly, The radial Artery terminates, in its Passage over the semi-inter-osseous Muscle of the Index, near the Basis of the first metacarpal Bone, and as it runs under the Tendons of the Flexor Muscles of the Fingers, where it is connected to the Curvature of the Cubitalis.

It sends off another Branch which runs along the anterior Part of the first metacarpal Bone, to the convex Side of the Index, where it is lost in the Integuments.

It likewise gives a Branch to the internal lateral Part. of the Index, which, at the End of that Finger, joins an opposite Branch which comes from the

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the Arch of the Cubitalis ; it also sends off a small Branch cross the internal inter-ossæous Muscles, where it forms a kind of small irregular Arch, which communicates with the great Arch by several small arterial Rami.

When the Curvature of the Cubitalis ends at the Middle Finger, the Radialis runs along the internal or concave Part of the first metacarpal Bone, at the Head of which it terminates by two Rami.

One of these Rami runs along the interior and anterior lateral Part of the Index ; the other passes between the Flexor Tendons of this Finger and the metacarpal Bone, and, having communicated with the cubital Branch of the Middle Finger, advances on the posterior lateral Part of the Index all the way to the End of that Finger, where it unites again with the first Branch.





LECTURE XIX.

ANGEIOGRAPHY of the ARTERIES continued.

THE LEFT DIAPHRAGMATIC ARTERY arises commonly from the Aorta Descendens, as it passes between the Crura of the small Muscle of the Diaphragm; the RIGHT DIAPHRAGMATIC comes sometimes from the nearest lumbar Artery, but commonly from the Cæliaca: Sometimes both these Arteries arise, by a small common Trunk, immediately from the Aorta. They likewise have the Name of ARTERIÆ PHRENICÆ.

They appear almost always, in several Ramifications, on the concave or inferior Side of the Diaphragm, and seldom on the superior or convex. They give small Rami to the Glandulæ Renales or Capsulæ Atrabilariæ, which sometimes communicate with the other Arteries that go to the same Part.

They likewise send small Rami to the Fat that lies upon the Kidneys called the Membrana Adiposa, whence they have the Name of ARTERIÆ ADIPOSÆ; and they sometimes come immediately from the Trunk of the Aorta on one Side of the Mesenterica Superior.

Besides these capital diaphragmatic Arteries, there are others, of a subordinate Class, which
come

come from the *Intercostales*, *Mammariæ Internæ*, *Mediastinæ*, *Pericardiæ*, and *Cæliacæ*, as before.

The *CÆLIAC ARTERY* arises anteriorly, and a little on the Left, from the *Aorta Descendens*, immediately after its Passage thro' the small Muscle of the Diaphragm, nearly opposite to the Cartilage between the last dorsal Vertebra and first lumbar. The Trunk of this Artery is very short; and near its Origin it sends off, from the right Side, two small *Diaphragmaticæ*, tho' sometimes there is only one which goes to the right Side, and is afterwards distributed both Ways, communicating with the other Arteries, of the same Name, which come from the *Intercostales* and *Mammariæ*. The left Branch sends *Rami* to the superior Orifice of the Stomach, and to the *Glandula Renalis* on the same Side; the right furnishes the *Pylorus*, and the renal Gland on the right Side.

Immediately after this, the *Cæliacæ* gives off a considerable Branch called *Arteria Ventriculi Coronaria*, and *Gastrica*, or *Gastrica Superior*; and then it presently divides into two large *Rami*; one towards the right Side, named *Arteria Hepatica*; the other to the left, called *Splenica*, which is larger than the former.

Sometimes this Artery is divided into these three *Rami* at the same Place, very near its Origin; the Trunk going out from the *Aorta* almost in a straight Line, and the *Rami* from the Trunk almost at right Angles, like *Radii* from an Axis; whence this Trunk has been called *AXIS ARTERIÆ CÆLIACÆ*.

The *CORONARY ARTERY OF THE STOMACH* goes first to the left Side of that Organ, a little beyond the superior Orifice, round which Orifice it throws *Rami*, and also to every Part of the Stomach near it; and these *Rami* communicate with

with those which run along the Basis of the Stomach to the Pylorus.

Afterwards it runs on the right Side of the superior Orifice, along the small Curvature of the Stomach, almost to the Pylorus, where it communicates with the Arteria Pylorica; and, turning towards the small Lobe of the Liver, it gives off some Rami to it.

Then it advances, under the Ductus Venosus, to the left Lobe of the Liver, in which it loses itself near the Beginning of the just mentioned Duct, having first given off some small Rami to the adjacent Parts of the Diaphragm and Omentum.

As soon as the HEPATIC ARTERY leaves the Cæliaca, it runs to the superior and interior Part of the Pylorus, in Company with the Vena Porta, sending off two Rami, a small one called Arteria Pylorica, and a large one named Gastrica Dextra, or Gastrica Major.

The PYLORICA is ramified on the Pylorus; and, having distributed Rami to the adjacent Parts of the Stomach, which communicate with those of the right Gastrica, it terminates on the Pylorus by an Anastomosis with the coronary Artery of the Stomach.

The RIGHT GASTRIC ARTERY, having passed behind and beyond the Pylorus, sends out a considerable Branch called Arteria Duodenalis, or Intestinalis, which sometimes comes from the Trunk of the Hepatica; afterwards this gastric Artery runs along the right Side of the great Curvature of the Stomach, to the circumjacent Parts of which, on both Sides, it distributes Rami.

These Rami communicate with those of the Arteria Pylorica and of the Coronaria Ventriculi, and with the right Gastro-Epiploicæ; which furnish the nearest Parts of the Omentum, and communicate

nicate with the Mesenterica Superior; after this, the right Gastric Artery terminates in the left, which is a Branch of the Splenica.

The DUODENAL or INTESTINAL ARTERY runs along the Duodenum on the Side next the Pancreas, to both which it furnishes Rami, and also to the adjacent Part of the Stomach. Sometimes this Artery arises from the Mesenterica Superior, and sometimes it is double.

The HEPATIC ARTERY, having sent out the Pylorica and right Gastrica, advances, behind the Ductus Hepaticus, towards the Vesicula Fellis, to which it gives two principal Rami called Arteriæ Cysticæ, and another named Biliaria, which is lost in the great Lobe of the Liver.

Afterwards this Artery enters the Fissure of the Liver, and joins the Vena Porta, with which it runs within a membranous Vagina called Capsula Glissoni, and accompanies it, thro' the whole Substance of the Liver, by numerous Ramifications, which may be termed ARTERIÆ HEPATICÆ PROPRIÆ.

Before it enters the Liver, it gives small Rami to the external Membrane of this Viscus, and to the Capsula Glissoni: The gastric and proper hepatic Arteries come sometimes from the Mesenterica Superior, when the ordinary Ramifications are wanting.

Immediately after the Origin of the SPLENIC ARTERY from the Cæliaca, it runs towards the left Side, under the Stomach and Pancreas, to the Spleen: It adheres closely to the posterior Part of the inferior Side of the Pancreas, to which it gives several Rami named Arteriæ Pancreaticæ.

Near the Extremity of the Pancreas, under the left Portion of the Stomach, the splenic Artery gives off a principal Ramus called Gastrica Sinistra, or Minor, which runs from left to right

along the left Portion of the great Curvature of the Stomach, giving Rami to both Sides of this Portion, which communicate with those of the Coronaria Ventriculi.

This GASTRIC ARTERY likewise sends another Ramus, at least, to the Extremity of the Pancreas, which communicates with the other pancreatic Arteries; it also supplies the Omentum with Rami called Gastro-Epiploicæ Sinistræ, and then communicates with the right Gastrica; and from this Union the Gastro-Epiploicæ Mediæ are produced*.

Afterwards the splenic Artery advances towards the Spleen, in a Course more or less contorted; but, before it arrives at that Viscus, it gives two or three Rami to the large Extremity of the Stomach, commonly called Vasa Brevia; and one to the Omentum, named Epiploica.

At the Spleen this Artery divides into four or five Rami, which enter that Viscus, after having given some small Twigs to the adjacent Parts of the Stomach and Omentum.

The SUPERIOR MESENTERIC ARTERY arises anteriorly from the inferior Portion of the descending Aorta, a very little way below the Cæliaca, going out a little towards the Right, but bending immediately afterwards to the Left.

Near its Origin it gives off a small Ramus, which, separating into two, goes to the inferior Side of the Head of the Pancreas and adjacent Part of the Duodenum, communicating with the Intestinalis by small Curvatures and Areolæ.

* From this Detail we learn, that the Arteria Coronaria Ventriculi Pylorica, Intestinalis, both Gastricæ, Gastro-Epiploicæ, and, consequently, the Hepatica, Splenica, and Mesenterica, communicate with each other.

Afterwards it passes over the Duodenum, between this Intestine and the meseraic Vein, between the two Laminæ of the Mesentery; and then bending, in an oblique Direction, from left to right, and from above downwards, by very small Degrees, it advances towards the Extremity of the Ilium: By this Incurvation it forms a kind of long Curvature, from the convex Side of which a great many Rami egress.

These Rami are about sixteen or eighteen, and most of them are bestowed on the small Intestines, from the inferior third Part of the Duodenum to the Cæcum and Colon: The first Rami are very short; and thence they increase gradually; in Length, all the way to the Middle of the Curvature, the rest diminishing gradually.

As they approach the Intestines, all these Rami communicate first by reciprocal Curvatures; then by Areolæ of all Kinds of Figures, from which is detached an infinite Number of small Ramifications, which surround the intestinal Canal like an annular Piece of Net-work.

These Curvatures and Areolæ increase, in Number, proportionably to the Length of the Rami; and their Size diminishes gradually as they approach the Intestines.

The first Rami from the convex Side of the mesenteric Curvature, which are very short, supply the Pancreas and Meso-colon, and communicate with the duodenal Artery; the last Rami go to the Appendicula Vermiformis, and send a curved Portion to the Beginning of the Colon.

The considerable Rami from the concave Side of the mesenteric Curvature are seldom above two or three; but, before they arise, a small Ramus goes out to the Duodenum, and gives some very small Arteries to the Pancreas.

The first considerable Ramus from the concave Side of the Curvature goes into the Meso-colon towards the right Portion of the Colon, being first divided into two Rami; the first of which runs along the whole superior Part of the Colon, where it forms the famous Communication with the Mesenterica Inferior, and might be called Arteria Colica Superior; the other Ramus of this Branch descends on the right Portion of the Colon.

The second principal Ramus, having run, for some Space, thro' the Mesentery, divides into three Rami; the first of which goes to the inferior Part of the right Portion of the Colon, where it communicates with the second Ramus of the first Branch; the second goes to the Beginning of the Colon, where it communicates with the first, and to the Intestinum Cæcum; the third Ramus of this second Branch, having communicated with the second, gives small Twigs to the Cæcum, Appendicula Vermiformis, and Extremity of the Ilium: Afterwards it communicates with the Extremity of the curved Trunk of the superior Mesenteric.

All these Communications are by Curvatures, as in those Rami that come from the convex Side of the Curvature: And it is to be observed in general, that all the Rami of the Mesenterica Superior are disposed according to the Plicæ of the Mesentery and Circumvolutions of the Intestines; giving off Rami, thro' their whole Course, to the Laminæ of the Mesentery, its cellular Substance, and to the mesenteric Glands.

The INFERIOR MESENTERIC ARTERY rises anteriorly from the Aorta Descendens, about a Finger's Breadth above the Bifurcation, and below the spermatic Arteries; and, having run about
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the Length of an Inch, it is divided into three or four Rami, which separate gradually.

The first or superior Ramus, about an Inch from its Origin, divides into two Rami; the first of which runs along the left Portion of the Colon, and forms the Communication of the two mesenteric Arteries already mentioned: It may be named *Arteria Colica Sinistra*. The second Ramus, having communicated with the first, descends upon the same Portion of the Colon.

The middle Ramus, having run the same Length with the first, divides into two Rami; one of which ascends on the Extremity of the Colon, communicating by Curvatures with the second Ramus of the superior Ramus; the other descends on the Extremity of the same Intestine.

When there is another middle Ramus, it goes to the first Part of the double Curvature of the Colon, by a like Distribution and Communication from above downwards.

The inferior Ramus goes to the second Portion of the Colon, or to both, when the second middle Ramus is wanting, and sends up a Ramus, that communicates with the former.

It sends another considerable Ramus inferiorly, called *Arteria Hæmorrhoidalis Interna*, which descends behind the *Intestinum Rectum*, to which it is distributed by several Ramifications, and communicates with the *Arteriæ Hypogastricæ*.

The RENAL ARTERIES, commonly called EMULGENTS, are ordinarily two, and rise laterally from the inferior descending Aorta, immediately under the *Mesenterica Superior*, one to the right Side, the other to the left. The right is situated more posteriorly, and is longer than the left, because of the *Vena Cava*, which lies on the right Side between the Aorta and the Kidney.

They commonly run without Division, and almost horizontally to the Kidneys, into the Depressions of which they enter by several Rami, which form Curvatures in the internal Substance of these Viscera.

From these Curvatures numerous Ramuli arise towards the Circumference or external Surface of the Kidneys; sometimes there is more than one Artery on each Side, sometimes this Augmentation is only on one Side, and these supernumerary Arteries come sometimes immediately from the Aorta, and enter at the superior or inferior Part of the Kidneys*.

The Arteries of the renal Glands, which may be termed *ARTERIÆ CAPSULARES*, arise sometimes from the Aorta above the *Arteria Renalis*, and give out the *Arteriæ Adiposæ* which go to the Fat of the Kidneys: Sometimes they come from the Trunk of the *Cæliaca*. The right capsular Artery commonly comes from the *Arteria Renalis* of the same Side, near its Origin; the left from the Aorta, above the *Renalis*.

The *SPERMATIC ARTERIES* are commonly two, sometimes more: They are very small, and arise anteriorly from the Aorta Descendens, near each other, about a Finger's Breadth below the *Arteriæ Renales*, more or less, between the two *Mesentericæ*, or between the *Renales* and *Mesentericæ Inferiores*. Sometimes one is higher, or placed more laterally than the other.

They send off, to the common Membrane of the Kidneys, small Rami called *ARTERIÆ ADIPOSÆ*, and afterwards descend upon the *Psoas*

* Commonly the right Renal Artery passes behind the Vena Cava and Renal Vein on the other Side; and the left Artery, first behind, and then before the Veins: Sometimes they send Rami to the *Glandulæ Renales*, *Membrana Adiposa* of the Kidneys, and even to the Diaphragm.

Muscles, on the anterior Side of the Ureters, between the two Laminæ of the Peritonæum.

They give several considerable Rami to the Peritonæum, chiefly to those Parts of it which are next the Mesentery, and communicate with the Mesentericæ and Adiposæ: They likewise send small Arteries to the Ureters.

Afterwards they pass, in Men, thro' the tendinous Apertures of the abdominal Muscles in the Vagina of the Peritonæum, and are distributed to the Testicles and Epididymes, where they communicate with a Ramus of the Iliaca Externa.

In Women they do not go out of the Abdomen, but are distributed to the Ovaria and Uterus, and communicate with Rami of the Hypogastrica, at the fimbriated Extremities of the Tubæ Fallopiæ.

The LUMBAR ARTERIES egress posteriorly from the inferior descending Aorta, in five or six Pairs, or more, much in the same Manner with the Intercostals.

They may be divided into SUPERIOR and INFERIOR. The superior send small Rami to the adjacent Parts of the Diaphragm and intercostal Muscles, and supply the Place of semi-intercostal Arteries: Sometimes those Pairs egress by a small common Trunk, and not separately.

They are distributed, on each Side, to the Psoas Muscles, Quadrati Lumborum, and the oblique and transverse Muscles of the Abdomen; and, by perforating the oblique Muscles, become external hypogastric Arteries: They go likewise to the vertebral Muscles, the Bodies of the Vertebrae, and enter the spinal Canal, thro' the lateral Scissures, to go to the Membranes, &c. forming Rings, much in the same Manner with the Intercostals; they likewise give small Twigs to the Nerves.

The *ARTERIÆ SACRÆ* arise commonly from the posterior Part of the inferior Aorta, at the Bifurcation; sometimes they arise higher from the *Lumbares*, sometimes lower from the *Iliacæ*. They are two, three, or four, and sometimes but one; are ramified on the *Os Sacrum* and adjacent Parts of the *Peritonæum*, *Intestinum Rectum*, *Fat*, &c. and enter the Canal of that Bone thro' the anterior *Foramina*, being there distributed towards each Side; they likewise send small Arteries to the large *Fasciculi* of Nerves which egress thro' the *Foramina* of the *Os Sacrum*, and penetrate the internal Substance of that Bone.

The inferior Aorta terminates at the last lumbar Vertebra, and sometimes higher, in two large lateral Rami, one on the right Side, the other on the left, called *ARTERIÆ ILIACÆ*; each of which is a common Trunk to two other Arteries of the same Name: This Bifurcation lies on the anterior and left Side of that of the *Vena Cava*.

The primitive *ILIAC ARTERIES* divaricate gradually as they descend, advancing obliquely towards the anterior and inferior Part of the *Ossa Ilium*, without any considerable Ramification for about the Breadth of three Fingers, except a few very small Arteries that go to the *Os Sacrum*, some of which enter by the superior *Foramina*, and are distributed like the *Arteriæ Sacræ*, while others emerge again thro' the posterior *Foramina*, and go to the adjacent Muscles, &c. they likewise give small Arteries to the *Peritonæum*, *Tunics* of the Veins, and to the *Fat* and *Ureters*, behind which the iliac Trunks pass.

The right iliac Trunk passes first on the anterior Side of the Origin of the left iliac Vein, and descends on the anterior Side of the right Vein,
almost

almost to the Place where it goes out of the Abdomen, its Course being there directed more internally; the left Trunk descends likewise before the left Vein, but lies a little towards the internal Side as it leaves the Abdomen.

About three Fingers Breadth from their Origin, each iliac Trunk is divided into two secondary Arteries, one external, the other internal. The external Artery has no particular Name; the internal is called *HYPOGASTRICA*, which often appears to be no more than a Ramus of the other, in Adults; but in young Children, and especially in the Fœtus, the hypogastric Artery looks like the Trunk, and the other like a Branch.

The external *ILIACA* on each Side descends on the iliac Muscle to the *Ligamentum Fallopii*, under which it egresses from the Abdomen: In this Course it gives off only a few small Arteries to the *Peritonæum* and Parts adjacent; but, as it passes out of the Abdomen under the Ligament, it detaches two considerable Rami, one internal, the other external.

The internal Ramus is named *ARTERIA EPIGASTRICA*, and egresses anteriorly from the external *Iliaca*; thence it ascends obliquely on the Tendon of the transverse Muscle towards the posterior Part of the *Rectus*, which it reaches about two or three Fingers Breadth above the *Os Pubis*.

Afterwards the epigastric Artery ascends along the posterior or interior Side of this Muscle, sending Ramifications to the Tendons of the adjacent Muscles, &c. and then loses itself by a true Anastomosis of several Ramifications, with the *Mammaria Interna*: It likewise communicates with the inferior *Intercostals* that are spread on the Abdomen.

It sometimes gives out to particular Rami, one of which, accompanied by a Nerve, goes thro' the

the Foramen Ovale of the Pelvis to the triceps Muscles, &c. the other descends to the Testicles, along with the spermatic Artery, and there communicates with it.

The external Ramus of the external Iliaca goes off laterally from the exterior Side of that Artery under the Ligamentum Fallopii, and thence to the internal Labium of the Os Ilium, where it divides into two, and is ramified on the oblique and transverse Muscles of the Abdomen, communicating with the Arteria Lumbaris.

Besides these two Rami, the external Iliaca gives off a small Ramus internally, under the Ligament, which runs to the Vagina of the spermatic Vessels; and sometimes another small Twig goes from the external Side to the Os Ilium.

The internal ILIACA, or HYPOGASTRICA, having run a little more than a Finger's Breadth internally and backwards, bends, by small Degrees, obliquely forwards, and towards the external Side; and afterwards, contracting in its Dimensions, it terminates in the umbilical Artery, which ought to be looked upon as a true Continuation of the Trunk of the Hypogastrica.

This ARTERIA UMBILICALIS ascends on the Side of the Bladder, and, having detached small Rami to that Viscus, and to the adjacent Parts of the Peritonæum, &c. it contracts, and in Adults is quite closed up, above the Middle of the Bladder; it likewise gives Rami to the Uterus and the adjacent Parts, in both Sexes: Afterwards it ascends, in Form of a Ligament, to the Umbilicus, where it joins the umbilical Artery on the other Side; its Name being taken from its Use in the Foetus.

From the convex Side of the Curvature of the hypogastric Artery, four or five principal Rami commonly egress, very near each other; sometimes

times they all arise separately, sometimes by small common Trunks; and what is the first Branch in some Subjects, is only a Ramus of another principal Branch in others; so much does the Number, Disposition, Origin, and Distribution of these Branches, vary in different Subjects. For this Reason, we think proper to distinguish them by the following Names; Iliaca Minor, Glutæa, Sciatica, Pudica or Pudica Hypogastrica, and Obturatrix.

The ILIACA MINOR, the most posterior of these Rami, and which is often no more than a Ramus of the Glutæa, passes between the last two lumbar Nerves, and divides into two Rami; one of which enters the Canal of the Os Sacrum thro' the lowest large anterior Foramina; the other passes behind the Musculus Psoas, to which it gives Twigs, and behind the crural Nerve, being afterwards distributed to the iliac Muscle, and to the middle Part of the internal Side of the Os Ilium; penetrating into the Substance of the Bone sometimes by one Foramen, sometimes by more.

The ARTERIA GLUTÆA is commonly very considerable, and sometimes the largest of all the hypogastric Rami: Near its Beginning it sometimes sends out the Iliaca Minor, and sometimes the small Ramus that goes from that Artery to the Os Sacrum and other Parts fixed to that Bone; afterwards this Artery egresses from the Pelvis, in Company with the sciatic Nerve, thro' the superior Part of the great Sinus of the Os Innominatum, below the Musculus Pyriformis, and is distributed, in a radiated Manner, to the Glutæus Maximus and Medius.

In its Passage it gives some Rami to the Os Sacrum, Os Coccygis, Musculus Pyriformis, the Muscles of the Anus, and to the adjacent Parts of the Intestinum Rectum; forming a particular
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Hæmorrhoidalis Interna : It likewise sends Twigs to the Bladder and Parts adjacent, and detaches a pretty long Ramus which descends with the sciatic Nerve.

The *ARTERIA SCIATICA* gives first some Rami to the *Musculus Pyriformis*, *Quadrigeminus*, *Os Sacrum*, &c. and even to the internal Side of the *Os Ischium* : it likewise detaches a Ramus which runs under the *Musculus Quadratus*, to the Articulation of the Femur.

It passes obliquely over the sciatic Nerve ; and as they both go thro' the great posterior Sinus of the *Os Ilium*, it detaches small Arteries which are distributed to the internal Substance of that Nerve : Afterwards it ascends, in a radiated Manner, on the external Side of the *Os Ilium*, and is distributed to the internal Substance of that Bone, and to the *Musculi Glutæi*, especially to the *Medius* and *Minimus*.

The *PUDICA COMMUNIS*, commonly called *PUDICA INTERNA*, sometimes arises by a Trunk common to it and to the *Glutæa*, and gives out two principal Rami ; the first of which passes thro' the great Sinus of the *Os Ilium*, in Company with the *Glutæa* and *Sciatica*, and then divides into two Rami.

The first Ramus goes behind the Spine of the *Ischium*, between the two Ligaments which lie between that Bone and the *Os Sacrum*, and runs on the internal Side of the *Tuberculum Ischii*, all the way to the Origin of the *Corpus Cavernosum Penis* : There it divides into several Arteries, one of which goes to the *Sphincter Ani*, under the Name of *Hæmorrhoidalis Externa*.

The rest are distributed to the adjacent Integuments, Bulb of the Urethra, and to the *Corpus Cavernosum Penis* ; but the last of these Arteries, or rather the Extremity of this first Ramus, runs
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from behind forwards, over the Cervix of the Femur, and communicates with a Ramus of the Arteria Cruralis.

The second principal Ramus, commonly called ARTERIA PUDICA EXTERNA, runs between the Bladder and Intestinum Rectum, and is distributed, in Men, to the Vesiculæ Seminales, Cervix of the Bladder, prostate Gland, and adjacent Parts of the Rectum.

Afterwards it runs under the Os Pubis on the Side of a considerable Vein, which lies directly under the Symphysis; and it runs along the Penis between this Vein and a Nerve, being distributed, in its Passage, to the Corpus Cavernosum, and communicating with the Pudica Minor, which comes from the Cruralis.

This second Ramus of the Pudica Major goes off, sometimes, separately from the Hypogastrica, especially in Women, being distributed to the lateral Parts of the Uterus, where it communicates with the spermatic Artery near the jagged Extremity of the Tuba Fallopiana, and to the adjacent Parts of the Vagina, &c.

The ARTERIA OBTURATRIX perforates the obturator Muscles, and egresses from the Pelvis at the superior Part of the Ligament of the Foramen Ovale, having first sent a small Ramus over the Symphysis of the Os Ilium and Os Pubis, to the inguinal Glands and Integuments.

As it passes by the Muscles it divides, and is distributed to the Pectinæus and Triceps; it likewise sends out another Ramus, which communicates with that Ramus of the Sciatica that goes to the Articulation of the Femur, and gives small Arteries to the Foramina in the Cervix of that Bone.

After-

Afterwards the HYPOGASTRIC ARTERY terminates in the Umbilicalis, as before.

The iliac Artery egresses from the Abdomen between the Ligamentum Fallopii and Tendon of the Psoas at the Union of the Os Ilium and Os Pubis, and there it takes the Name of ARTERIA CRURALIS.

It first sends off three small Rami, one of which, called Pudica Externa, passes over the crural Vein to the Skin and Ligament of the Penis, and to the inguinal Glands, communicating with the Pudica Interna: The second goes to the Musculus Pectinæus, and the third to the superior Part of the Sartorius. All these Rami likewise furnish the adjacent anterior Integuments.

Afterwards the crural Artery descends on the Head of the Femur, and, by taking a particular Turn, gets on the internal Side of the crural Vein, about three Fingers Breadth from where it egresses from the Abdomen: From its Origin to this Place, it is covered only by the Skin and Fat, and lies on the Pectinæus and Triceps Primus.

In changing its Situation it sends out three considerable Rami; one external, one middle, and one internal: They all egress more or less posteriorly, sometimes by a short common Trunk, sometimes by two, &c.

The external Ramus runs on the superior Side of the Thigh to the Cruræus, Vastus Externus, Rectus Anterior, Musculi Fasciæ Latæ, and Glutæus Medius; sending up a Ramus to the Apex of the Trochanter Major, which communicates with the first principal Ramus of the Pudica Major and Sciatica.

The middle Ramus descends on the internal Side of the Thigh between the triceps Muscles, to which it gives several Rami; one of which perforates the second Muscle, and is distributed to
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the Glutæus Maximus, Semi-Nervosus, Semi-Membranosus, Biceps, and to the adjacent Integuments.

The internal Ramus runs posteriorly, on the Quadrigemini, towards the Trochanter Major, and, having detached a Ramus which goes into the Articulation of the Femur, it descends, and gives Rami to all the Muscles that lie posteriorly on that Bone, one of which enters the Bone itself on one Side of the Linea Aspera.

Having sent off these three Rami, the crural Artery descends between the Sartorius, Vastus Internus, and Triceps, giving Rami to the Parts adjacent. It is covered by the Sartorius all the way to the inferior Part of the Thigh, where it is inflected posteriorly over the Triceps Tertius a little above the internal Condyle of the Femur; afterwards, continuing its Course thro' the Hollow of the Ham, it is called Arteria Poplitæa, being accompanied by the Vein of the same Name.

The ARTERIA POPLITEA, while in the Ham, is covered only by the Integument, sending off Rami towards each Side, which ascend upon the Condyles, and communicate with the inferior Ramifications of the crural Artery.

It sends Rami to the Articulation of the Knee, one of which, at least, passes between the crucial Ligaments. As it descends it sends Rami to the Gastrocnemii and Poplitæus, and, having reached the posterior Side of the Head of the Tibia, gives off two Rami, one to each Side.

The first or internal Ramus surrounds the anterior Part of the Head of the Tibia, passing between the Bone and internal lateral Ligament; and, besides several other Ramifications, sends up a small Branch that communicates with the Arteries which lie round the Condyles of the Femur.

The second or external Ramus runs over the Head of the Fibula, and between the Head of the Tibia and external lateral Ligament of the Knee, surrounding the Articulation all the way to the Ligaments of the Patella, and communicating with the Rami which lie round the Condyles of the Femur, together with a Branch of the first or internal Ramus.

Immediately after the Origin of these two Rami, and before the Poplitæa ends, it sends a small Artery down on the posterior Side of the inter-osseous Ligament, very near the Tibia, into which it enters, by a particular Foramen, a little above the middle Portion of the Bone.

As the Poplitæa ends, it divides into two principal Rami, one of which runs between the Heads of the Tibia and Fibula, passing from behind anteriorly on the inter-osseous Ligament, where it takes the Name of Arteria Tibialis Anterior; the second Ramus divides into two others; one internal and largest, called Arteria Tibialis Posterior; the other posterior and smallest, named Arteria Peronæa Posterior.

The ARTERIA TIBIALIS ANTERIOR, having passed between the Heads of the Tibia and Fibula, sends small Rami superiorly and laterally. The superior communicate with those Rami of the Poplitæus which lie round the Articulation; and the lateral ones go to the Parts adjacent: Afterwards this tibial Artery descends on the anterior Side of the inter-osseous Ligament, towards the external Side of the Tibia, between the Musculus Tibialis Anticus and Extensor Pollicis.

Having run laterally on the Tibia for about two Thirds of the Length of that Bone, it passes, on the anterior Side, under the common annular Ligament, and Extensor Pollicis, to the Articulation of the Foot, giving off several Rami to the
right.

right and left Sides, which communicate laterally with the Tibialis Posterior and Peronæa Posterior, so that these two Bones are, in a Manner, surrounded by Arteries.

At the Articulation of the Foot it sends out Rami which run between the Astragalus and Os Calcis, being distributed to the Articulation and the Bones of the Tarsus. The Communications are here very numerous, on all Sides.

Having passed the Fold of the Foot, it sends off, towards both Sides, other Rami, which communicate with the posterior Tibialis and Peronæa, all these Rami making a kind of Circles round the Tarsus.

Afterwards the anterior tibial Artery advances, on the convex Side of the Foot, as far as the Interstice between the first and second metatarsal Bones, between the Heads of which it sends a large Branch, which perforates the superior inter-osseous Muscles, and, joining the Tibialis Posterior, forms a Curvature on the Side of the Foot.

It likewise sends two or three considerable Rami over the other metatarsal Bones, which go to the rest of the inter-osseous Muscles, Integuments, &c. and communicate with each other.

Lastly, This Artery terminates by two principal Rami, one of which goes to the Thénar and internal Side of the Great Toe; the other is spent upon the external Side of the Great Toe and internal Side of the Second.

The ARTERIA TIBIALIS POSTERIOR, called likewise SURALIS, descends between the Solei, Tibialis Posticus, Flexor Digitorum Communis, and Flexor Pollicis; giving Rami to these Muscles, Tibia, and to the Marrow of that Bone, thro' a particular Canal in its posterior and superior Part.

Afterwards it runs behind the internal Ankle, communicating with the Tibialis Anterior, and surrounded by the adjacent Veins; and passes to the Sole of the Foot between the concave Side of the Os Calcis and thenar Muscle, where it divides into two Rami; one large, or external; the other small, or internal.

The great Ramus, or ARTERIA PLANTARIS EXTERNA, passes on the concave Side of the Os Calcis obliquely under the Sole of the Foot, to the Basis of the fifth metatarsal Bone, and thence runs, in a kind of Curvature, towards the Great Toe, communicating there with the Tibialis Anterior, which perforates the inter-osseous Muscles in the Manner already said.

The convex Side of this Curvature supplies both Sides of the last three Toes, and the external Side of the Second Toe, forming small communicating Curvatures at the End, and sometimes at the Middle of each Toe, as in the Hand: The concave Side of the Curvature furnishes the Parts adjacent.

The small Ramus, or ARTERIA PLANTARIS INTERNA, having reached beyond the Middle of the Sole of the Foot, is divided into two; one of which goes to the Great Toe, communicating with the Ramus of the Tibialis Anterior; the other is distributed to the first Phalanges of the other Toes, communicating with the Ramifications from the Curvature already mentioned.

The ARTERIA PERONÆA POSTERIOR descends on the posterior Side of the Fibula, between the Solæus and Flexor Pollicis, to which and the adjacent Parts it gives Rami, in its Passage.

Having reached to the inferior third Part of the Fibula, it sends off a considerable Ramus, which runs in between the Tibia and that Bone, passing between their Extremities from behind anteriorly,
below

below the inter-ossæous Ligament, and is distributed to the Integuments of the Tarsus.

Lastly, The Peronæa, continuing its Course downwards on the posterior Side of the Fibula, as far as the Os Calcis, forms a Curvature with the Tibialis Posterior, between the Astragalus and Tendo Achillis.

Thence it runs externally, and a little above the exterior Ankle communicates with the Tibialis Anterior by a Curvature, which sends several small Ramifications to the Parts adjacent.

OBSERVATIONS.

In this Description of the Arteries, we have said nothing of the cutaneous Anastomoses, which are exceedingly beautiful in a Fœtus; nor of the frequent and considerable Communications of small Arteries upon the Periostæum, which form a delicate kind of Rete Mirabile.

I found in a Man, between thirty and forty Years old, his Aorta considerably large, and partly ossified, at some Distance from the Curvature down to that Portion which perforates the superior Surface of the Diaphragm; and about an Inch before that Part which enters the Surface, was, in the internal Part of the Aorta near to that of the dorsal Vertebrae, a Cystis as large as a Nutmeg; another higher smaller, containing a crutaceous Matter: The Aorta was not dilated to more than its proper Diameter. In the same Subject the exhaling Vessels of Viscera were entirely obstructed; for the Pericardium adhered very closely to the Heart, and no Serum was found in it: The Pores of the Pericardium were very conspicuous, which, I presume, is what some Anatomists have taken for Glands.

It is common enough to find, in aged Subjects, the Aorta, as well as other Arteries, ossified: And some Authors relate, that they have found the semilunar Valves ossified.



LECTURE XX.

ANGEIOGRAPHY of the VEINS.

FROM the SUPERIOR VENA arise the SUBCLAVIAN VEINS.

The RIGHT SUBCLAVIAN VEIN is very short, and its Course very oblique; so that it appears to rise higher than the LEFT. It sends off, first, four large Rami; viz. the Vertebralis, which is the first, and most posterior; Jugularis Interna, Jugularis Externa, and Axillaris.

The LEFT SUBCLAVIAN seems to ascend but very little, after the Bifurcation, because it runs farther, and more transversely, than the RIGHT; and, in this Course, it covers the Origin of three large Arteries, which come from the Curvature of the Aorta. It sends off four large Rami, besides the small pectoral Veins, and receives the Ductus Thoracicus.

It likewise gives off, before its principal Division, a small Trunk for the left superior Intercostals, which are sometimes six, and communicate with the inferior Intercostals, and with a Ramus of the Vena Azygos: This small common intercostal Trunk likewise furnishes the left Bronchialis.

Each subclavian Vein, near the Middle of the Clavicula, sends off a Ramus called Cephalica, that descends, near the Surface of the Body, between the Deltoïdes and Pectoralis Major, and reaches the Arm.

Each

Each EXTERNAL JUGULAR VEIN arises from the Subclavian on the same Side, sometimes from the Axillaris, and sometimes from the Union of these two Veins. The right and left do not always arise in the same Manner; for sometimes the right comes from the Subclavian, and the left from the internal Jugular on the same Side: They ascend between the Musculus Cutaneus and Sterno-Mastoidæus, being covered by the former, and crossing over the latter.

Sometimes they are double from their Origin; and, when they are single, each of them divides afterwards into two, one anterior, the other posterior, or rather superior. The anterior Vein goes to the Throat and Face, ascending towards the Angle of the inferior Maxilla; and the posterior goes to the Temples and Occiput.

The ANTERIOR EXTERNAL JUGULAR VEIN is often a Ramus of the Jugularis Interna, and sometimes arises from the Communications of the two Jugulares in such a Manner, as that it cannot be said to belong more to one than the other. Sometimes, but very rarely, it comes from the Vena Axillaris.

It ascends towards the lateral Part of the inferior Maxilla, between the Angle and the Chin, like a Vena Maxillaris, and sends several Rami anteriorly, posteriorly, and interiorly.

Posteriorly it gives, 1. A large Ramus on the Side of the superior Part of the Larynx, which communicates with the Jugularis Interna; and likewise with a large short Ramus of the Jugularis Externa Posterior. 2. A small Ramus that has the same Communication, but which is not always to be found. 3. Another small Ramus, a little below the inferior Maxilla, that communicates with the Jugularis Externa Posterior.

Anteriorly it sends several Rami to the Muscles of the Larynx, Sterno-Hyoïdæi, Thyro-Hyoïdæi, and to the Integuments; and below the Larynx it sends communicating Rami to the Jugularis Externa Anterior of the other Side.

A little higher, opposite to the Cartilago Thyroïdes, it gives off a transverse Ramus, which runs on the anterior and inferior Part of the Musculi Sterno-Mastoïdæi, and communicates with the Jugularis of the other Side, tho' not always by a Vein of the same Kind.

The superior and inferior transverse Rami communicate, on each Side, by Rami more or less perpendicular, and send a small Ramus to the Musculus Quadratus of the Chin, to the Musculus Cutaneus and Integuments.

It sends another large Ramus anteriorly towards the Symphysis of the inferior Maxilla, which, after having supplied the maxillary Glands, is distributed to the digastric Muscle, the Chin, and inferior Lip.

Interiorly, at the same Place, it sends out a large Ramus, which furnishes the Glandulæ Sublinguales, descends towards the Cornua of the Os Hyoïdes, to communicate with some Rami of the Jugularis Interna, and sends several Rami to the Tongue called Venæ Raninæ. It likewise gives off a small Ramus, which, running upon the Musculus Labiorum Triangularis to the Commissure of the Lips, is distributed to the Parts adjacent.

The same Ramus that gives out the Venæ Raninæ, detaches another to the lateral Parts of the Septum Palati, which is distributed to the Amygdalæ and Uvula, and sends Rami anteriorly to the Membrane which lines the Curvature of the Palate: Another Ramus egresses from it to the Pterygoïdæus Internus, Peristaphylini, and Cephalopharyngæi.

After,

Afterwards the Trunk of the anterior external jugular Vein ascends on the Musculus Triangularis, where it receives the Name of VENA TRIANGULARIS, in a winding Course from the Angle of the inferior Maxilla to the great or internal Angle of the Orbit, sending Rami, on each Side, to the Muscles and Integuments.

These Rami communicate with each other, especially one which passes under the Zygoma, behind the Os Malæ, to the inferior Orbital or spheno-maxillary Fissure; and another small Ramus, that runs along the inferior Portion of the orbital Muscle to the small or external Angle of the Eye, where it communicates with the Rami Temporales and Frontales*.

The Trunk of the Vena Angularis, having reached the Bones of the Nose, sends out a Ramus thro' the lateral Cartilages of the Nose, which is distributed to the Nares; and another that runs, in a winding Course, to the superior Lip.

At the great or internal Angle of the Eye the same Trunk sends off several other Rami, the first of which goes to the Root of the Nose, and, communicating with its Fellow from the other Side, gives several small Veins to the Foramina of the Offa Nasi.

The second Ramus ascends on the Forehead, by the Name of VENA FRONTALIS (antiently PRÆPARATA), and is distributed to each Side, com-

* It is here to be observed, that, under the Angle of the inferior Maxilla, there is a great Variety of Communications between the external and internal jugular Veins, and also a great Variety in the Distribution of these Veins.

Most of these Ramifications, which at this Place go from the external jugular Vein, to be distributed on the superior Part of the Throat and Face, in some Subjects, arise, in others, from the internal Jugular; and sometimes one Part of them comes from the external Jugular, the rest from the internal.

communicating with its Fellow, when any such Vein is found.

The third Ramus enters the Orbit, in a winding Course, on one Side of the cartilaginous Pulley, and communicates with the Sinuses of the Dura Mater by the orbitary Sinus of the Eye.

The fourth Ramus goes along the Musculus Superciliaris and superior Part of the Orbicularis, to the small or external Angle of the Eye, to communicate with the Vena Temporalis and that Vein which runs along the inferior Part of the orbicular Muscle, with which it forms a kind of Circle.

The POSTERIOR or SUPERIOR EXTERNAL JUGULAR VEIN ascends towards the parotid Gland and inferior Part of the Eye, giving out several considerable Rami towards each Side.

At its Origin it sends out posteriorly a principal Ramus, with its Ramifications, to the Muscles which cover the Scapula and Articulation of the Humerus, commonly called VENA MUSCULARIS, and which might be named SUPER-HUMERALIS.

A little higher it gives off the VENA CERVICALIS that goes to the vertebral cervical Muscles: This Vein communicates with the Humeralis by several Areolæ, and they are both ramified in different Manners.

These Ramifications and Communications are partly covered by the Musculus Trapezius, and communicate likewise with some Rami of the Vena Occipitalis and a Branch of the superior intercostal Vein, which perforates the first intercostal Muscle.

Near the cervical Vein, but a little more externally, it sometimes gives off the small VENA CEPHALICA, which descends between the Pectoralis Major and Deltoïdes, and unites with the brachial VENA CEPHALICA.

Posteriorly it detaches the *VENA OCCIPITALIS*, which is distributed on the Occiput, and sometimes comes from the *Vena Vertebralis*, or *Axillaris*, &c. it likewise sends out a small Vein, that enters the Cranium by the posterior mastoid Foramen, and terminates in one of the lateral Sinuses of the *Dura Mater*: This Ramus sometimes comes from another Vein.

Having reached as far as the parotid Gland, it forms Communications with the anterior external Jugular, under the Angle of the inferior Maxilla, and then passes thro' the parotid Gland, between that Angle and the Condyle, giving off a large Ramus that communicates with another Ramus common to the internal and anterior external Jugulars.

Sometimes there are several Rami, which, having run a very little Way, unite, and represent the short large Ramus, forming *Areolæ*, thro' which the Nerves pass.

Afterwards it passes before the Ear, taking the Name of *VENA TEMPORALIS*, which is distributed to the Temples and lateral Parts of the Head, towards the Occiput and Forehead. Sometimes the temporal Vein has two Origins, whereof one is from the *Jugularis Interna*.

The *TEMPORAL VEIN* of one Side communicates above with its Fellow on the other Side; before with the *Vena Frontalis*, and behind with the *Vena Occipitalis*. Opposite to the Ear it gives out a large Branch, one Ramus of which runs under the inferior Margin of the Zygoma, and then, returning, communicates with another Ramus from the same *Jugularis*, a little below the Condyle of the inferior Maxilla, forming a kind of Island irregularly round.

Behind this Condyle it gives Rami to the temporal Muscle, to the adjacent Parts of the superior

Maxilla and internal Side of the inferior Maxilla, almost in the same Manner as the Arteries.

Only one of these Rami runs from without internally, between the condyloid and coronoïd Apophyses, to be distributed to the Musculus Temporalis and Pterygoïdæi, sending off a Ramus to the Masseter, in its Passage.

The INTERNAL JUGULAR VEIN is the largest of all those that go to the Head, tho' not so large as it seems to be when injected.

It ascends behind the Sterno-Mastoïdæus and Omo-Hyoïdæus, which it crosses; along the Sides of the cervical Vertebrae, by the Margin of the Longus Colli, to the Fossula of the Foramen Lacernum of the Basis Cranii.

The first Rami which it sends off are small, and go to the thyroïd Glands; about two Fingers Breadth higher up it detaches a middle-sized Ramus that runs laterally towards the Larynx, and may be named Vena Gutturalis.

This GUTTURAL VEIN divides chiefly into three Rami, the lowest of which goes to the thyroïd Gland and adjacent Muscles, the middle one to the Larynx, Musculi Thyroïdæi, &c. and the third ascends to the great Communication between the two Jugulares already mentioned. In this, however, there is some Variety; and we have seen the left guttural Vein egress from the Axillaris.

About the same Distance upwards, almost opposite to the Os Hyoïdes, the internal Jugular gives another Branch, which sends Rami to the Muscles belonging to that Bone, and others that communicate with the foregoing Ramus. This other Ramus ascends towards the parotid Gland and Angle of the inferior Maxilla, where it sends communicating Rami anteriorly and posteriorly to the two external Jugulares.

It is at this Place, likewise, that the internal Jugular sometimes produces the *VENA MAXILLARIS INTERNA*, and all its Ramifications, as has been already said.

The internal Jugular sends another Ramus posteriorly, which is distributed to the Occiput, where it communicates with a Ramus of the *Vertebralis*; and thro' the posterior mastoid Foramen, with the lateral Sinus of the *Dura Mater*: This Communication is sometimes by an Anastomosis with a Ramus of the external Jugular, or of the *Cervicalis* which goes thither.

Afterwards it reaches the Foramen Lacerum of the *Basis Cranii*, bending a little, and sending off small Twigs to the Pharynx and adjacent Muscles.

The *VERTEBRAL VEIN* arises posteriorly from the *Subclavia* or *Axillaris*, sometimes by two Stems, sometimes by one, which soon afterwards divides into two.

The first and principal Stem gives out a Ramus called *VENA CERVICALIS*, which is distributed to the adjacent Muscles, and afterwards ascends thro' the Foramina of the transverse Apophyses of the *Vertebræ Colli*: This cervical Ramus sometimes comes from the *Axillaris*.

The other Stem ascends on the Side of the *Vertebræ*, and, having reached the fourth, or sometimes higher, it runs in between the transverse Apophyses of that Vertebra and the fifth, to join the first or principal Stem.

Thus the vertebral Vein accompanies the Artery of the same Name, sometimes in one Trunk, sometimes in several Stems, thro' all the Foramina of the transverse Apophyses of the *Vertebræ Colli*, all the way to the great Foramen Occipitale, communicating with the occipital Veins and small occipital Sinuses of the *Dura Mater*.

In its Passage it gives off one Ramus that enters by the posterior condyloid Foramen of the Os Occipitis, and communicates with the lateral Sinus of the Dura Mater; but it is not always to be met with.

As these Veins run thro' the Foramina in the transverse Apophyses, they send Rami forwards to the anterior cervical Muscles and small interior Muscles of the Head.

Other Rami likewise go externally and backwards to the Musculi Transversales and Vertebrales Colli, and internally to the great Canal of the spinal Marrow, where they form Sinuses that communicate with those on the other Side.

These vertebral Sinuses are pretty numerous, and placed, one above another, all the way to the Occiput; the lower communicate with the superior, and at the great Foramen of the Os Occipitis there is a Communication between them and the occipital Sinuses of the Dura Mater.

The VENA AZYGOS, or SINE PARI, is very considerable, and arises posteriorly from the superior Cava a little above the Pericardium.

Immediately afterwards it is bent posteriorly over the Origin of the right Lung, forming a Curvature which surrounds the great pulmonary Vessels on that Side, as the Curvature of the Aorta does those of the left Side, with this Difference only, that the Curvature of the Azygos is almost directly backwards; whereas that of the Aorta is oblique.

From thence it descends on the right Side of the Vertebrae Dorsi on one Side of the Aorta, and before the intercostal Arteries; and, getting behind the Diaphragm, terminates; by a very sensible Anastomosis, sometimes with the Vena Renalis, sometimes with an adjacent lumbar Vein, some-

sometimes immediately with the Trunk of the Cava Inferior, and sometimes otherwise*.

The Vena Azygos sends out first two or three small Veins from the Top of the Curvature, one of which goes to the Aspera Arteria, the others partly to the Aspera Arteria, and partly to the Bronchia, by the Name of *VENÆ BRONCHIALES*, accompanying the Ramifications of the bronchial Artery.

Afterwards the Azygos detaches from the Extremity of the Curvature a small Trunk common to two or three small Veins, called *INTERCOSTALES SUPERIORES DEXTRÆ*, which receive the Blood from the first three Series of intercostal Muscles, and the adjacent Part of the Pleura.

These intercostal Veins send Rami, thro' the intercostal Muscles, to the Serratus Posticus Superior, Serratus Major, &c. and afterwards they run along the Interstices between the Ribs, communicating with the *Venæ Mammariæ*.

They likewise send small Rami posteriorly to the vertebral Muscles and Canal of the Spine, where they communicate with the venal Circles or Sinuses which bring back the Blood from the *Medulla Spinalis*.

As the Azygos descends, it sends off the inferior intercostal Veins on the right Side, one going to each Series of intercostal Muscles: These Veins run along the inferior Margins of the Ribs, and perforate the Muscles by Rami, which go to the posterior and external Part of the Thorax.

They communicate with the *Venæ Thoracicæ*, and commonly with the *Mammaria Interna*; and,

* I have seen this Vein extremely large, resembling the Trunk of the inferior Cava, from the Diaphragm to the Origin of the Renales; the true Cava being, through all this Space, very narrow, or of the Size of an ordinary Azygos. WINSLOW.

lastly, more or less with each other, by perpendicular Rami, near the posterior Extremities of the Ribs*.

The INFERIOR INTERCOSTAL VEINS, to the Number of six or seven, sometimes more, sometimes fewer, often come from the Trunk of the Azygos; and running between the Aorta and Vertebrae, to the Substance of which they give small capillary Twigs, they send off almost the same Ramifications with the Veins on the right Side, and likewise some to the Oesophagus.

Sometimes these intercostal Veins come from a small common Trunk which goes out from that of the Azygos, and, passing between the Aorta and Vertebrae, is bent downwards along the left Side of the Vertebrae, in which Course it detaches the Intercostals laterally: This small Trunk is, in some Subjects, bifurcated superiorly and inferiorly, as it sends off the Intercostals; and, in others, there are two small common Trunks.

Lastly, There is sometimes an intire Azygos on the left Side, which, proceeding from the Curvature of the ordinary Azygos, is afterwards distributed in the same Manner as the other on the right Side; but this Disposition likewise varies very much.

The Azygos, having reached below the last Rib, sends off a large Ramus, which, flexing externally, perforates the Muscles of the Abdomen, is ramified between their different Planes, and communicates with the like Ramifications of the last, or two last intercostal Veins.

Sometimes it sends off the VENA DIAPHRAGMATICA INFERIOR, and likewise gives down-

* The Azygos likewise sends off the left intercostal Veins, but seldom the whole Number; for the superior Veins often come from the left Subclavian.

wards to the first, or two first transverse Apophyses of the Vertebrae Lumbares, a Ramus that forms the first *VENÆ LUMBARES DEXTRÆ* *.

The *PECTORALES INTERNÆ* are small Veins disposed in Pairs towards the right and left Sides, behind the Sternum and Parts adjacent, including the *Diaphragmaticæ Superiores* or *Pericardio-Diaphragmaticæ*, *Mediastinæ*, *Mammariæ Internæ*, *Thymicæ*, *Pericardiæ*, and *Gutturales* or *Tracheales*.

All these small Veins are divided into right and left; and these are both distributed much in the same Manner; but they differ in their Origins, because of the Inequality in the Bifurcation of the Cava Superior.

The *RIGHT VENA MEDIASTINA* arises anteriorly from the Trunk of the superior Cava, a little above the Origin of the Azygos; the left comes from the Subclavia.

The *RIGHT SUPERIOR DIAPHRAGMATICA*, or *PERICARDIO-DIAPHRAGMATICA*, comes anteriorly from the Radix of the Bifurcation near the Mediastina, and is distributed, by several Rami, to the superior, anterior, and posterior Parts of the Pericardium, communicating with those of the left Diaphragmatica, and accompanying the Nerve of the same Name.

The *LEFT SUPERIOR DIAPHRAGMATICA* comes from the left Subclavian a little below the Origin of the Mammaria.

The *RIGHT INTERNAL MAMMARIA* arises anteriorly from the Vena Cava, a little below the

* These Communications between the last intercostal and first lumbar Veins are very irregular, being sometimes by a Series of opposite Angles, sometimes by Areolæ, or a reticular Texture, &c. Sometimes the Extremity of the Vena Azygos communicates either mediately or immediately with the Vena Adiposa, and even with the Vena Spermatica.

Angle of the Bifurcation : It runs along the nearest internal or posterior Margin of the Sternum, and on the cartilaginous Extremities of the right Ribs, together with the Artery of the same Name. Having reached near the Diaphragm, it sends a Ramus that runs towards the tendinous Plane, and communicates with the common diaphragmatic Veins.

Afterwards this mammary Vein gives small Rami to the Mediastinum, and others between the Ribs to the Integuments ; of which, those that pass between and under the Cartilages of the last true Ribs descend on the internal or posterior Side of the Musculi Recti Abdominis, being ramified among their musculous Fibres, and communicating really with the epigastric Veins by several Twigs.

The LEFT INTERNAL MAMMARIA arises anteriorly from the left Subclavian, opposite to the Cartilage or anterior Extremity of the first true Rib.

The RIGHT VENA THYMICA, when it arises separately, egresses from the Bifurcation ; and, when it is wanting, the Thomus, whence it takes its Name, is furnished by the Gutturalis, or some other adjacent Vein. This Vein often reaches no lower than the inferior Part of the Thymus ; and the left Vein of the same Name comes from the left Subclavian, almost opposite to the Sternum.

The RIGHT PERICARDIA seems to rise rather from the Origin of the right Subclavian, than from the Trunk of the superior Cava ; but in this there are many Varieties. It goes to the superior Side of the Pericardium and Parts adjacent.

The LEFT PERICARDIA comes sometimes from the left Subclavian, before the Mammaria, and sometimes from the Mammaria or Diaphragmatica Superior on the same Side.

The RIGHT GUTTURALIS, or TRACHEALIS, arises from the superior Part of the Bifurcation, above the Mammaria of the same Side, sometimes more posteriorly, and sometimes from the Subclavia: It is distributed to the Glandulæ Thyroïdææ, Trachea Arteria, Musculi Sterno-Hyoïdæi, Thymus, and Glandulæ Bronchiales; communicates by lateral Rami, more or less contorted, with the internal jugular Vein; and sometimes, by another Ramus, with a small Vein which the internal Jugular sends to the Glandula Thyroïdes.

The LEFT GUTTURALIS comes from the superior or posterior Part of the left Subclavian, near its Origin.

The smallest INTERNAL PECTORAL VEINS do not always arise separately, but have sometimes a small common Trunk, especially on the right Side; and, of all these small Veins, the MAMMARIA INTERNA is the most considerable.

The SUBCLAVIAN VEIN, having sent off the Rami already described, goes out of the Thorax, and passes before the anterior Portion of the Musculus, and between the first Rib and Clavicle, to the Axilla.

Thro' this Course it takes the Name of VENA AXILLARIS, and gives off several Rami, the chief of which are, the Venæ Musculares, Thoracicæ, and Vena Cephalica, which is sometimes double.

The first Veins which it sends off are the MUSCULARES, distributed to the middle Portion of the Musculus Trapezius, the Angularis, Infra-Spinatus, and Sub-scapularis: And as some of these Rami go to the Shoulder exteriorly, others interiorly; the Venæ Scapulares are distinguished into external and internal.

A little before the Axillaris reaches the Axilla, it sends out the VENÆ THORACICÆ, one of which is superior, called also MAMMARIA EXTERNA,

and the other inferior: It likewise sends Rami to the Musculus Sub-scapularis, Teres Major and Minor, Supra-Spinatus, Latissimus Dorsi, Serratus Major, Pectorales Minor and Major, and to the Glands of the Axilla; and sometimes gives a communicating Branch to the Vena Basilica.

The Axillaris, having reached the Side of the Head of the Humerus, produces a very considerable Branch named Vena Cephalica, and afterwards runs along the Arm by the Name of Vena Basilica; which, however, sometimes appears to be rather a Branch, than a Continuation, of the Trunk of the Axillaris: In which Case, the Cephalica and Basilica might be looked upon as two principal Rami of the axillary Vein.

The CEPHALIC VEIN, which is a Branch of the Axillaris, at a small Distance from its Origin joins the small Cephalica that descends from the Subclavia, or Jugularis Externa; having, till then, run near the Surface of the Body between the Deltoides and Pectoralis Major; and sometimes these two Veins communicate before their Union.

The GREAT CEPHALICA descends between the Tendons of the last mentioned Muscles, and along the external Margin of the external Portion of the Biceps; communicating, several Times, with the Vena Basilica, and sending small Rami, on each Side, to the adjacent Muscles, Fat, and Skin. Some Rami go out from its superior Part, which, lower down, unite again with the Trunk.

A little below the external Condyle of the Humerus it detaches a Ramus posteriorly, which ascends between the Musculus Brachialis and superior Portion of the Supinator Longus, and afterwards bends back between the Humerus and Anconæus Externus, where it communicates with some Rami of the Basilica.

Having

Having reached very near the Fold of the Arm, it is divided into two principal Rami, one long, the other short: The long Ramus is named Radialis Externa, and the short one may be called Mediana Cephalica, to distinguish it from another Mediana, which is a short Ramus of the Basilica; and therefore ought to be called VENA MEDIANA BASILICA.

The EXTERNAL RADIAL VEIN runs along the Radius between the Muscles and Integuments, giving off Rami, towards both Sides, that communicate with other Rami of the same Vein, and with some from the Basilica; forming Areolæ in much the same Manner as the Saphena does in the inferior Extremity.

The MEDIANA CEPHALICA descends obliquely towards the Middle of the Fold of the Arm, under the Integuments, and over the Tendon of the Biceps, where it joins a short Ramus of the same kind from the Basilica, as before.

These two MEDIANÆ unite in an Angle, the Apex of which is turned posteriorly.

From this angular Union a considerable Ramus egresses, which descends on the Fore-Arm, connecting on one Side with the Vena Cephalica, and communicating on the other with the Basilica by several irregular Areolæ.

The Name of MEDIANA is given to this large Ramus, as well as to the two short ones, by the Union of which it is formed; but, that they may not be confounded, this large Ramus may be called MEDIANA MAJOR or MEDIA, the Names already given to the other two being retained.

From this Union of the two lateral Medianæ, and sometimes from the Origin of the Mediana Media, which is the true Mediana of RIOLANUS, a Ramus egresses which descends on the internal Side of the Fore-Arm, opposite to the inter-osseous

Ligament, and is called *VENA CUBITI PROFUNDA*: It goes to the adjacent Muscles, and communicates with the other Veins of the Fore-Arm.

The *Mediana Cephalica* sometimes sends down a long Ramus, called *RADIALIS INTERNA*, which lies almost parallel to the *Radialis Externa*, already mentioned.

Afterwards the *Cephalica*, having reached the Extremity of the Radius, is distributed by numerous *Areolæ*, almost in the same Course with the radial Artery.

A particular Ramus arises from it, which runs more or less superficially between the Thumb and Metacarpus, by the Name of *CEPHALICA POLICIS*.

The *Areolæ* furnish the inter-osseous Muscles and Integuments, and communicate with a small Ramus from the Basilica, called, by the Antients, *SALVATELLA* *; which has sometimes a double Origin, by a Branch of Communication with the Trunk of the Axillaris.

It sends off first, under the Head of the Humerus, a pretty large Ramus, that passes almost transversely round the Neck of that Bone from within backwards, and from behind outwards, ascending on the Scapula, where it is ramified on the *Deltoides*, and communicates with the *Venæ Scapulares Externæ*.

This Ramus may be named *VENA SUB-HUMERALIS*, or *ARTICULARIS*, as the Artery which lies in the same Place; they both having much the same Course.

* They termed the *BASILIC VEIN* of the Right Arm the Vein of the Liver, or *VENA HEPATICA BRACHII*; and that of the Left Arm, the Vein of the Spleen, or *VENA SPLENICA BRACHII*.

This articular Vein sends down two principal Rami, one of which runs along the internal Side of the Bone, to which, and the Periosteum, it gives small Veins; the other turns anteriorly towards the Middle of the Arm between the Bone and Biceps, and communicates with the Cephalica.

Below the Cervix of the Humerus, near the Hollow of the Axilla, and behind the Tendon of the Pectoralis Major, the Basilica sends out a considerable Ramus, that descends on the Side of the brachial Artery, and furnishes the adjacent Muscles on both Sides. This Vein is named PROFUNDA BRACHII, or PROFUNDA SUPERIOR*.

These small Veins, which often arise from the Profunda Superior, communicate with the Basilica and Cephalica; and, having reached the Fold of the Arm, they divide like the Artery, and the same Divisions are continued along the whole Fore-Arm, thro' all which Space they accompany and surround the arterial Rami, as before.

Afterwards the Basilica continues its Course along the internal Side of the Humerus, between the Muscles and Integuments, forming many Communications with the Vena Profunda, Satellites, and Cephalica, and supplying the Muscles and Integuments.

Having reached the internal Condyle, and sent off obliquely, in the Fold of the Arm, the Mediana Basilica, it runs along the Ulna, between the Integuments and Muscles, a little towards the external Side, by the Name of CUBITALIS EX-

* Immediately afterwards, the Basilica detaches two or three small Veins, which descend very closely joined to the brachial Artery, surrounding it at different Distances by small Twigs, which communicate with each other. These Veins might be named VENÆ SATELLITES ARTERIÆ BRACHIALIS.

TERNA, still communicating with the Profunda, Satellites, and Cephalica.

Having detached the Mediana Basilica, it sends out another Ramus, that descends along the internal Side of the Fore-Arm near the Ulna, and communicates with the Mediana Major, &c. This Ramus may be named CUBITALIS INTERNA.

The Basilica having at length reached the Extremity of the Ulna, sends several Rami to the convex Side of the Carpus; one of which, named Salvatella, goes to that Side of the Little Finger next the Ring Finger, having first communicated with the Cephalica by means of the venal Areolæ conspicuous on the Back of the Hand. In the other Fingers this Vein follows nearly the same Course with the Artery*.

* In general, the external or superficial Veins of the Fore-Arm are larger than the internal; but they are accompanied only by small Arteries; whereas the deep Veins accompany large Arteries.





LECTURE XXI.

ANGEIOGRAPHY of the VEINS continued.

THE INFERIOR VENA CAVA, having descended about a Quarter of an Inch from the right Auricle of the Heart, within the Pericardium, as has been already said, pierces that Membrane, and the tendinous Portion of the Diaphragm, which adhere very closely to each other.

At this Place it gives off the VENÆ DIAPHRAGMATICÆ or PHRENICÆ, which are distributed to the Diaphragm, and appear chiefly on its inferior Side, one towards the right, and another towards the left Side. The right Vein is more backwards and lower than the left; the left is distributed partly to the Pericardium, and partly to the Diaphragm; and sometimes they send Rami to the Capsulæ Renales, much in the same Manner as the Arteriæ Phrenicæ.

The inferior Cava, having perforated the Diaphragm, passes thro' the posterior Part of the great Fissure of the Liver, penetrating a little into the Substance of that Viscus, between the great Lobe and Lobulus Spigelii, being covered but very little on the posterior Side by the Substance of the Liver, till it reaches the Lobulus.

In its Passage it commonly sends off three large Rami, called VENÆ HEPATICÆ, which are ramified

mified in the Liver. Sometimes there are only two, at other Times four.

Besides these large Rami, it sends out other small ones, either before or immediately after it egresses from the Liver; which, according to some Anatomists, answer to the Rami of the Hepatic Artery, as the large Rami do to those of the Vena Porta*.

After its Passage thro' the Liver, the Vena Cava turns from before backwards, and from right to left, towards the Spina Dorsi, placing itself on the right Side of the Aorta, which it accompanies thence inferiorly.

Having descended as low as the Arteriæ Renales, it gives off the Veins of the same Name, formerly called VENÆ EMULGENTES, which are the largest of all those that go from the Cava Inferior, from the Liver to the Bifurcation.

The RIGHT RENAL VEIN is the shortest, and descends a little obliquely, because of the Situation of the Kidney.

The LEFT VEIN, which is longest, crosses on the anterior Side of the Trunk of the Aorta, immediately above the superior mesenteric Artery; and both Veins accompany the renal Arteries.

They send superiorly the VENÆ CAPSULARES, which go to the Glandulæ Renales; and inferiorly the VENÆ ADIPOSÆ, which go to the fatty Covering of the Kidneys; and generally the left renal Vein furnishes the left spermatic Vein.

Afterwards they run to the Sinus or Cavity of the Kidneys, in the Substance of which they are distributed by numerous Ramifications.

* In a Fœtus, as the Vena Cava passes by the Liver, it gives off the Ductus Venosus, which communicates with the Sinus of the Vena Porta; but in Adults is degenerated into a flat Ligament.

A little below the renal Veins, the Trunk of the Cava sends anteriorly, towards the right Side, the RIGHT SPERMATIC VEIN.

The LEFT SPERMATIC VEIN commonly arises from the left Renalis; and both Veins accompany the spermatic Arteries.

In their Course they send several small Rami, on each Side, to the Peritonæum and Mesentery, where they seem to be joined, by Anastomoses, to the Venæ Mesaraicæ, and, consequently, with the Venæ Portæ.

They sometimes send a considerable Ramus over the iliac Muscle, which afterwards dividing into two, one Ramus ascends to the Membrana Adiposa of the Kidneys, the other descends on the last mentioned Muscle*.

The Cava likewise sends off posteriorly the VENÆ LUMBARES, which commonly arise in Pairs in the same Manner as the Arteries of the same Name rise from the Aorta: These may be divided into superior and inferior Veins.

Their Origins vary in different Manners. Sometimes the Cava gives off a Ramus to each Side below the first lumbar Vertebra, which, like a common Trunk, furnishes the lumbar Veins: This Ramus communicates with the Vena Azygos†.

* About the same Height with the spermatic Vein, the inferior Cava sends off posteriorly, in some Subjects, a Ramus which ascends and communicates with the Vena Azygos. Sometimes this Ramus goes out from one or other of the Renales, and appears to be a true Continuation of the Extremity of the Azygos.

† Sometimes a considerable Ramus arises from the inferior Extremity of the Cava, near the Bifurcation, chiefly on the right Side; which afterwards ascending between the Bodies and transverse Apophyses of the Vertebrae, detaches the Venæ Lumbares, and communicates with the Azygos.

At other Times a like Ramus comes from the Beginning of the left Vena Iliaca, and, ascending on that Side in the same Manner, produces the Lumbares. This Ramus likewise communicates with the Azygos and superior or descending Ramus Lumbaris.

The Venæ Lumbares on one Side communicate, by transverse Rami, with those of the other; and likewise with each other, by Rami more or less longitudinal. The first and second often go from the Azygos, and thereby they communicate with the intercostal Veins.

The lumbar Veins send small Capillaries, in their Passage, to the Substance of the Bodies of the Vertebrae: and they are distributed to the Muscles of the Abdomen, Quadratus Lumborum, Psoas, Iliacus, &c. They send Rami posteriorly to the adjacent vertebral Muscles and Canal of the Spine, and communicate with the venal Sinuses in the same Manner as the Intercostals.

The inferior Cava, having reached as low as the last lumbar Vertebra, and near the Bifurcation of the Aorta, runs in behind the right iliac Artery, and is there divided into two subaltern Trunks called the RIGHT and LEFT ILIAC VEINS.

The Extremity of the Trunk of the Vena Cava passes, in some Subjects, behind the Origin of the right iliac Artery; in others it is the left iliac Vein that passes there, and, consequently, crosses the right iliac Artery: Afterwards the left iliac Vein accompanies the internal Side of the left Artery till it egresses from the Abdomen; therefore the iliac Veins lie on the internal Sides of the Arteries at this Place.

From this Bifurcation of the Vena Cava, and often from the Origin of the left Iliaca, the VENA SACRA goes out, and accompanies the Artery of the same Name in its Distribution to the Os Sacrum, the Nerves that lie there, and to the Membranes which cover both Sides of that Bone.

Each original ILIAC VEIN is divided on the Side of the Os Sacrum, much after the same Manner as the Arteries, into two large Trunks, or secondary iliac Veins: This second Bifurcation is
about

about a Finger's Breadth below that of the iliac Arteries.

One of these Trunks is named *VENA ILIACA EXTERNA*, or *ANTERIOR*; the other *INTERNA*, or *POSTERIOR*: The external Vein is likewise named, simply, *ILIACA*; and the internal, *HYPogastrica*. The external Vein seems to be the true Continuation of the Trunk, and the *Hypogastrica* only a Ramus. In *Fœtuses* there are considerable Variations.

These Veins follow nearly the Course and Distribution of the iliac Arteries, except that the hypogastric Vein does not send off the *Vena Umbilicalis*. The external iliac Veins lie more or less on the internal Side of the Arteries, in the Manner already said; but the hypogastric Veins, in the Bottom of the Pelvis, lie almost behind the Arteries on the same Side.

From the common Trunk of the iliac Veins, and sometimes from the Origin of the *Iliaca Externa*, a particular Ramus egresses, which is distributed to the *Musculus Psoas*, *Iliacus*, and *Quadratus Lumborum*; and afterwards sends a Ramus on the anterior Side of the last transverse lumbar Apophysis, to communicate with the last lumbar Vein.

The *EXTERNAL ILIAC*, a little before it leaves the Abdomen, near the *Ligamentum Fallopii*, lying on the *Psoas* and iliac Muscles, gives off almost the same Rami with the Artery of the same Name, and follows the same Course. The chief Rami are these:

A little before it egresses from the Abdomen it sends off, from the external Side, a Ramus that ascends along the *Crista* of the *Os Ilium*, and gives Rami, on each Side, to the lateral and posterior lower Portions of the *Musculi Abdominis*, *Musculus Iliacus*, &c.

From

From the internal Side, before it leaves the Abdomen, it sends off the *VENA EPIGASTRICA*; which, having furnished some small Rami to the adjacent conglobated Glands, ascend along the internal Side of the *Musculi Recti*, on which it is ramified both Ways; as also on the broad Muscles of the Abdomen by other small Rami, which penetrate from within externally.

Afterwards the *Vena Epigastrica* ascends, and joins the Ramifications of the *Mammaria*, by an equal Number, accompanying the epigastric Artery*.

Before the iliac Vein gets from under the *Ligamentum Fallopii*, it sends several small Rami to the adjacent lymphatic Glands; and immediately afterwards, losing the Name of *Iliaca*, it takes that of *CRURALIS*.

THE *HYPOGASTRIC* OR *INTERNAL ILIAC VEIN* runs behind the Artery of the same Name, making the same kind of Curvature, from which the following Rami egress.

From the posterior or convex Part of the Curvature it gives a Ramus to the superior lateral Part of the *Os Sacrum*, which is distributed to the *Musculus Sacer* or *Transverso-Spinalis Lumborum*, and other adjacent Muscles, and to the Cavity of the Bone, which it enters thro' the first great Foramen.

A little lower, on the same Side, it sends out another, that is distributed much in the same Manner with the former, and enters the second Foramen.

From the external lateral Part of the same Curvature, a little anteriorly, it sends out a large

* From the internal Side of the epigastric Vein a Ramus is sometimes detached to the *Musculus Obturator Internus*, where it joins another named *Vena Obturatrix*,

Ramus, which runs behind the great sciatic Sinus, and is distributed to the Musculi Glutæi, Pyriformis, and Gemelli.

Lower down, the same lateral Part of the hypogastric Vein gives out another large Ramus; which, having run a little way, detaches several Rami, and afterwards, reaching the Foramen Ovale of the Os Innominatum, perforates the obturator Muscles, communicates with the Vena Cruralis, and is distributed to the Musculus Pectinæus, Triceps, and adjacent Parts. This Vein is named Obturatrix.

Among the Rami sent off by the VENA OBTURATRIX, before it perforates the Muscles, one is situated exteriorly, and runs towards the sciatic Sinus, Musculus Iliacus, the superior Part of the Obturator Internus, and the Os Ilium, near its Symphysis with the Os Ischium.

Interiorly the same obturator Vein sends off another Ramus, which is distributed to the Ureters, Bladder, and internal Parts of Generation in both Sexes: It communicates with the spermatic Veins, and is more considerable in Females than Males.

Lastly, The hypogastric Vein runs posteriorly, and egresses from the Pelvis above the Ligament that lies between the inferior lateral Part of the Os Sacrum and Spine of the Ischium; and, as it goes out, is ramified chiefly upwards and downwards.

It sends a large Ramus superiorly to the lower Part of the Os Sacrum, and two or more inferiorly; which, running behind the same Ligament, are distributed to the Nates, Anus, adjacent Portion of the Musculus Pectinæus, and to the external Parts of Generation, nearly in the same Manner with the Artery that accompanies them.

The Veins that go to the Anus are named HÆMORRHOÏDALES EXTERNÆ, and those that go

go to the Parts of Generation, PUDICÆ INTERNÆ. The external Hæmorrhoidales communicate with the internal Veins of the same Name, that come from the small Vena Mesaraica, one of the Rami of the Vena Porta.

The CRURAL VEIN egresses under the Ligamentum Fallopii, on the internal Side of the crural Artery, and immediately gives small Rami to the inguinal Glands, Musculus Pectinæus, and Parts of Generation: These last are named PUDICÆ EXTERNÆ, and evidently communicate with the internal Veins of the same Name.

About an Inch below where it leaves the Abdomen, the crural Vein produces a large Ramus, which descends anteriorly between the Integuments and Sartorius, following the Direction of that Muscle most of the way to the internal Side of the Thigh.

This Ramus, having afterwards got beyond the Condyles of the Femur, descends between the Integuments and internal Angle of the Tibia, to the anterior Part of the internal Ankle, and is distributed to the Foot. All this large Ramus is named VENA SAPHENA, or SAPHENA MAJOR.

After the Origin of the SAPHENA, as the Trunk of the crural Vein descends, it sinks in between the Muscles, and is distributed to all the internal or deep Parts of the inferior Extremity, accompanying the crural Artery to the very Extremity of the Foot, being all along more considerable than the Artery, both for Capacity and Ramifications, a Thing very common in the Veins.

As the VENA SAPHENA is of very large Extent, we shall here describe it all together, and afterwards return to the VENA CRURALIS.

The VENA SAPHENA, in its Course from the Inguen to the Foot, is covered only by the Skin

and

and Fat: Immediately after its Rise, it gives small Veins to the inferior inguinal Glands; and then it gives out others more anteriorly, which, running under the Integuments, communicate with each other by numerous Areolæ. Sometimes these Communications come all from the Rami of one Branch.

This Vein, having descended on the Thigh, as low as the Middle of the Sartorius, sends off to the same Side several Rami, which communicate with each other, and with the superior Rami already mentioned; and, as they descend, they communicate again with the Trunk of the Saphena.

These two Sorts of Communications furnish a third collateral Kind, from which, likewise, particular Rami are detached, that communicate with each other at different Distances all the way to the Knee.

Between these superior and inferior Rami the Saphena sends posteriorly a particular Ramus, which, after being distributed to the Integuments that cover the Gracilis Internus and Triceps, turns posteriorly; and, a little below the Ham, runs in among the Muscles situated there, and communicates with another Ramus, that may be termed SAPHENA MINOR.

Afterwards the Trunk of the great Saphena descends on the internal Side of the Tibia, lying always near the Skin; and, at the superior Part of that Bone, it sends Rami externally and posteriorly.

The anterior Rami go to the Integuments on the superior Part of the Leg; the posterior, to those that cover the Gastrocnemii, and communicate with the Saphena Minor; and the external Rami are likewise distributed to the Fat and Integuments; and, having reached as low as the Middle

dle of the Tibia, it sends a communicating Ramus to the Trunk of the Saphena Major.

From this Communication a Ramus arises anteriorly, that runs along the Integuments of the Tibia all the way to the external Ankle, having, in its Passage, communicated again with the Saphena Major.

As the Saphena descends on the internal Side of the Tibia, it sends out a Ramus, near the Middle of that Bone, which ascends behind the Tendons of the Sartorius, Gracilis Internus, and Semi-Nervosus; then between the Tibia and superior End of the Solæus, and is joined, by an Anastomosis, to the crural Vein.

It likewise detaches, to the anterior Part of the Tibia, some Rami irregularly transverse; which, having been distributed to the Periostæum and Bone, communicate with other Rami already mentioned.

At the inferior Part of the Tibia the Saphena produces a considerable Ramus, that runs obliquely forwards, over the Articulation of the Tarsus, towards the external Ankle, sending off several Rami that communicate with each other, and with the Trunk of the Saphena.

Lastly, The Extremity of this Trunk passes on the anterior Side of the inner Ankle, and runs irregularly, under the Skin, along the Interstice between the first two metatarsal Bones towards the Great Toe, where this Vein terminates.

Having got below the internal Ankle, it sends a Ramus externally and anteriorly, which runs under, and, in some measure, accompanies the anterior tibial Artery. Interiorly it sends another Ramus, almost from the same Place, that passes under the Foot, communicating with the external tibial Vein by irregular Curvatures, from which Veins are sent to the Toes.

Lastly,

Lastly, Before the Saphena terminates at the Great Toe, it detaches a kind of transverse Curvature over the Metatarsus, which communicates, by several Rami, with that Curvature which lies on the Articulation of the Tarsus, and sends others to the Toes: This Curvature likewise gives off another Curvature, which ascends behind the external Ankle, and communicates with the Vena Tibialis Externa.

A CONTINUATION OF THE VENA CRURALIS.

The CRURAL VEIN, having sent off the Saphena, and small Rami for the Pectinæus, &c. descends on the Thigh behind the crural Artery: Opposite to the Trochanter Minor it produces two large short Rami, or one which afterwards divides into two, one of which is anterior, the other posterior.

The anterior Ramus runs more or less transversely forwards, to be distributed to the Vastus Internus, inferior Part of the Pectinæus, and of the second Triceps, and to the other two Muscles of the same Name, running in between them as it goes from one to the other.

The posterior Ramus runs more or less transversely backwards, and furnishes the Glutæi, Vastus Externus, and Beginning of the Biceps.

A little below these two Rami, about the superior Extremity of the Vastus Internus, the crural Vein produces a Ramus that descends on the Side of the Trunk, covering the crural Artery almost as low as the Ham, where it is again united to the Trunk by an Anastomosis, and sometimes it is continued separate a little way down on the Leg. It has the Name of VENA SCIATICA from the sciatic Nerve which it accompanies.

On the external Side of this Anastomosis the crural Vein gives off a Ramus that runs posteri-

only between the Biceps and adjacent Muscles, and so downwards on the posterior Side of the Leg a little exteriorly, and very near the Skin, all the way to the external Ankle. This Vein is named Saphena Minor, or Externa.

The SAPHENA MINOR, having got near the Integuments in its Course downwards, gives out a Ramus that runs posteriorly, and communicates with the Saphena Major about the Middle of the posterior Side of the Thigh.

Immediately above and below the Ham this Vein sends out other Rami, which likewise communicate with the Saphena Major, and, having descended about one third Part of the posterior Side of the Tibia, it sends off another Ramus which is afterwards re-united to the Trunk.

About the Beginning of the Tendo Achillis, the Saphena Minor runs externally in the Integuments towards the external Ankles, where it terminates in cutaneous Ramifications sent to every Side.

The crural Vein, having detached the Saphena Minor, descends between the Biceps and the other Flexors of the Leg, closely accompanied by the crural Artery, between which and the internal Condyle of the Femur it is situated.

A little above the Ham it takes the Name of VENA POPLITÆA; and, as it descends between the two Condyles, it gives Rami to the flexor Muscles, inferior and posterior Parts of both Vasti, and to the Fat that lies above the Interstice of the two Condyles.

It likewise gives off several other Rami, one of which ascends laterally between the external Condyle and Biceps, and then, turning anteriorly, is ramified in the same Manner with the Artery. Another Ramus goes posteriorly, sending Ramifications to the Beginning of the Gastrocnemii,

after

after which it descends, on the posterior Side of these Muscles, to the Tendo Achillis.

Near the internal Condyle the Poplitæa sends some lateral Rami to the Extremities of the adjacent Muscles, especially those of the Semi-Nervosus, Semi-Membranosus, &c. Lastly, it sends a Ramus towards the external Condyle, which having run, for a small Space, on the Peronæus Longus, goes back into the Trunk.

The Vena Poplitæa descends immediately behind the Muscle of the same Name, at the inferior Part of which it sends off several Ramifications to each Side, which separate and unite again in different Ways and Degrees; and afterwards it loses its Name, being divided into three considerable Rami, called Tibialis Anterior, Tibialis Posterior, and Peronæa; of which the Tibialis Posterior is most frequently a Continuation of the Trunk, and the other two like Rami.

The VENA TIBIALIS ANTERIOR, having distributed some small Rami from its very Beginning to the Muscles behind the Heads of the two Bones of the Leg, perforates the inter-ossæous Ligament from behind forwards, and runs between the superior Portions of the Musculus Tibialis Anticus and Extensor Digitorum Communis.

As soon as it pierces the inter-ossæous Ligament, it distributes small superficial Rami to the Head of the Tibia and Fibula, which run to the Articulation of the Knee, and communicate with the lateral Rami of the Vena Poplitæa.

Afterwards it separates into two or three Rami, which descend together on the anterior Side of the inter-ossæous Ligament in Company with the anterior tibial Artery, which they surround, at different Distances, by small communicating Circles.

These Rami, having reached the inferior Extremity of the Leg, unite in one, which after-

wards divides into several, the Ramifications of which are distributed to the Foot.

A particular Ramus egresses from the re-united Portion, which, at the inferior Part of the Leg, perforates the inter-osseous Ligament from before posteriorly, and communicates with the Vena Tibialis Posterior.

The *VENA TIBIALIS POSTERIOR* gives off, from its Beginning, a Ramus towards the internal Side, which is distributed to the *Gastrocnemii* and *Solæus*. This Vein is called *SURALIS*.

Afterwards the posterior Tibialis descends between the *Solæus* and *Tibialis Posticus*, giving Rami to each of them. It is divided, in the same Manner as the *Tibialis Anterior*, into two or three Rami, which, as they run, surround the corresponding Artery by small communicating Circles formed at different Distances.

It continues this Course, in Company with the Artery, as low as the external Ankle, furnishing the *Musculus Tibialis Posticus*, and the long Flexors of the Toes. At the inferior Part of the Leg it communicates with a transverse Ramus of the *Saphena*, and the anterior tibial Vein, as before.

Lastly, It passes, on the internal Side of the *Os Calcis*, under the Sole of the Foot, where it forms the *VENÆ PLANTARES*, by separating into several transverse Curvatures, which communicate with each other, with the *Saphena*, and send Ramifications to the Toes, nearly in the same Manner as the *Arteria Plantaris*.

The *VENA PERONÆA* is likewise double, and sometimes triple. It descends on the internal Side of the *Fibula*, almost in the same Direction with the *Arteria Peronæa*, which it likewise surrounds at different Distances, by communicating Rami, after the Manner of the *Tibialis Posterior*.

It descends as low as the external Ankle, communicating several Times with the Tibialis Posterior, and sending Ramifications to the adjacent Portions of the Musculi Peronæi and long Flexors of the Toes.

The last of these Communications makes the VENÆ PLANTARES, in some Subjects, to appear rather to come from this Vein, than from the Tibialis Posterior, from which they commonly arise.

* The VENA PORTÆ, or PORTARUM, so named because it returns from the Intestines, Stomach, Spleen, &c. into the Liver, is a large Vein, the Trunk of which is situated chiefly between the Eminences on the inferior or concave Side of the Liver.

It may be considered as composed of two large Veins, joined almost endways by their Trunks, from each of which the Branches and Ramifications egress in contrary or opposite Directions. One of these Trunks adheres to the Liver, and is ramified in that Viscus, its Branches accompanying the whole Distribution of the hepatic Artery.

The other Trunk is without the Liver, and sends its Rami to the Viscera supplied by the rest of the Arteria Cœliaca, and by the two Mesentericæ; that is, to the Stomach, Intestines, Pancreas, Spleen, Mesentery, and Omentum.

The first Portion of this Vein may be termed VENA PORTÆ HEPATICA, SUPERIOR, or MINOR, the Trunk of which is commonly known by the Name of SINUS VENÆ PORTARUM; the other may be called VENA PORTÆ VENTRALIS, INFERIOR, or MAJOR: And this is what we are now to describe, referring the Distribution of the other to the Lecture on the Liver.

* As the Vena Portæ does not communicate with the Vena Cava, we thought it would be most convenient to describe it the last.

The large Trunk of the Vena Portæ Inferior, or Ventralis, is situated under the inferior or concave Side of the Liver, and joined, by an Anastomosis, to the Sinus of the Vena Portæ Hepatica, between the middle and right Extremity of that Sinus; and, consequently, at a great Distance from the left: Thence it descends a little obliquely from right to left, behind or under the Trunk of the Arteria Hepatica, bending behind the Beginning of the Duodenum, and under the Head of the Pancreas; its Length being about five Fingers Breadth.

Having reached to the Head of the Pancreas, this Trunk loses the general Name of Vena Portæ, and terminates in three large principal Rami, which are distributed, by numerous Ramifications, to the Viscera already named.

The first Ramus is termed VENA MESARAICA, or MESARAICA MAJOR; the second, SPLENICA; and the third, HÆMORRHOÏDALIS INTERNA, or MESARAICA MINOR.

The Vena Mesaraica Major appears to be a Continuation of the Trunk of the Vena Portæ Inferior; the Splenica is a capital Ramus of that Trunk; and the Hæmorrhoidalis Interna has sometimes a common Origin with the Splenica, and sometimes is no more than a Ramus of that Vein. In some Subjects the Mesaraica Major and Splenica appear to arise by an equal Bifurcation of the Trunk of the inferior Vena Portæ; and in others, the Hæmorrhoidalis arises from the very Angle of that Bifurcation.

The inferior Vena Portæ, before the Formation of these three Rami, sends off from the Trunk several small Rami; which are, commonly, the Venæ Cysticæ, Hepatica Minor, Pylorica, Duodenalis; and, sometimes, the Gastrica Recta, and Coronaria Ventriculi.

All these small Veins sometimes arise separately; and, in other Subjects, some of them egress by small common Trunks. It sometimes happens, that several of them do not come immediately from the Trunk of the Vena Portæ, but from one of its great Rami.

The VENÆ CYSTICÆ run along the Vesicula Fellis from its Cervix to the Bottom; and as they are often no more than two in Number, they are called CYSTICÆ GEMELLÆ, a Name given likewise to the Arteries which accompany them. They egress from the right Side of the great Trunk near its Beginning, sometimes separately, sometimes by a small and very short common Trunk.

The VENA HEPATICA MINOR is commonly a Ramus of one of the Cysticæ, or of their common Trunk.

The VENA PYLORICA arises from the great Trunk, almost opposite to the Origin of the Cysticæ, and sometimes is only a Ramus of the right Gastrica: It passes over the Pylorus to the short Curvature of the Stomach, where it is joined, by an Anastomosis, to the Coronaria Ventriculi.

The VENA DUODENALIS, commonly called VENA INTESTINALIS, egresses from the great Trunk near the Cysticæ, and sometimes from the small common Trunk of these Veins: It is distributed chiefly to the Intestinum Duodenum, and sends likewise some Rami to the Pancreas.

There is another Vein called also DUODENALIS, which is a Ramus of the Gastrica of the same Side.

The VENA GASTRICA, or GASTRO-EPIPLOÏCA DEXTRA, and the CORONARIA VENTRICULI, come more seldom from the Trunk of the Vena Portæ than from its great Rami; with which we therefore choose to describe them.

The inferior Vena Portæ, having given off the Splenica, changes its Name to that of MESA-RAÏCA, or MESARAÏCA MAJOR, which often appears to be rather a Continuation of the Trunk, than one of the great Rami.

It bends towards the superior mesenteric Artery, sending off two Veins; and afterwards, ascending over that Artery, it accompanies it in those Portions of the Mesentery and Meso-colon which belong to the small Intestines, Cæcum, and right Portion of the Colon. As it descends, it forms an oblique Curvature almost like that of the Artery, which is likewise ramified on both the convex and concave Sides, but not so regularly.

The first particular Ramus from this Trunk is by RIOLANUS called VENA COLICA: It egresses from the anterior Part of the Trunk, before it joins the Artery, and runs directly to the Middle of the Colon, where it separates to the right and left, and forms Curvatures; on the left it communicates with the superior or ascending Ramus of the Hæmorrhoidalis, and on the right with the second Ramus of the Mesaraica.

This second Ramus is a little under the first, or Colica Anterior, and somewhat more towards the right Side. It may be named GASTRO-COLICA, and is soon divided into two Rami, one superior, the other inferior.

The superior Ramus of the Vena Gastro-Colica sends small Veins to the Head of the Pancreas, and forms the VENA GASTRICA, or GASTRO-EPIPLOÏCA DEXTRA, which goes from the Pylorus to the great Curvature of the Stomach, and communicates with the Gastrica Sinistra. In its Passage it supplies the Stomach and Omentum, and communicates with the Pylorica, Coronaria Ventriculi, &c. and sometimes it forms the PYLORICA,

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The inferior Ramus of the Vena Gastro-Colica, which may be called COLICA DEXTRA, goes to the right Portion of the Colon; and thence to the superior Part of that Intestine, where it is divided archways, and communicates with the right Ramus of the Colica Anterior, and with a Ramus of the Vena Cæcalis.

The Trunk of the great mesaraic Vein sends out sometimes, opposite to the Gastrica, a particular Ramus to the Omentum, called EPIPLOICA DEXTRA: But, almost immediately before it ascends over the mesenteric Artery, it produces two large Rami, very near each other, which pass behind and under the Artery, being distributed to the Jejunum, and Part of the Ilium, by numerous Ramifications, which form Curvatures and Areolæ like those of the Artery.

Afterwards the Trunk of the Mesaraica passes over the superior mesenteric Artery, to which it adheres very closely, and from the convex Side of its Curvature sends out several Rami almost in the same Manner with the Artery; but with this Difference, that oftentimes the Rami do not arise immediately from the Vein in such great Numbers; and each of them sends out many more Ramifications.

From the concave Side of the mesaraic Vein, a little below the Origin of the second Ramus from the convex Side, arises a Ramus called, by Riolanus, VENA CÆCALIS, which runs to the Beginning of the Colon, crossing one of the Rami of the superior mesenteric Artery.

This CÆCAL VEIN separates by two Curvatures, the superior of which communicates with the inferior Ramus of the Vena Gastro-Colica; the other, after having sent Ramifications to the Intestinum Cæcum, and Appendicula Vermiformis,

mis, communicates below with the Extremity of the great mesaraic Vein.

The *VENA SPLENICA* is one of the three great Rami of the *Vena Portæ*, and may be said to be, in some measure, a subordinate Trunk of that Vein: It runs transversely, from the right Side to the left, first under the Duodenum, and then along the inferior Side of the Pancreas, near the posterior Margin.

In this Course it gives off several Veins; viz. the *Vena Coronaria Ventriculi*, *Pancreaticæ*, *Gastrica* or *Gastro-Epiploica-Sinistra*, and *Epiploica Sinistra*: It likewise often gives Origin to the *Hæmorrhoidalis Interna*, the third capital Ramus of the *Vena Portæ*.

It terminates afterwards by a winding Course, being divided into several Rami that go to the Spleen; one of which produces the small Veins called by the Antients *VASA BREVIA*.

The *VENA CORONARIA VENTRICULI*, so called because it surrounds, more or less, the superior Orifice of the Stomach, runs along the small Curvature of that Viscus towards the Pylorus, where it joins, and becomes continuous with the *Vena Pylorica*. In its Passage it gives several Rami to the Sides of the Stomach, which there form numerous *Areolæ*, and communicate with the Veins of the great Curvature.

It arises pretty often from the Beginning of the *Splenica*, and sometimes from the left Side of the Extremity of the great Trunk of the *Vena Portæ*, behind the hepatic Artery; and, in that Case, it is the most considerable of all the small Veins that egress from the great Trunk.

The *VENÆ PANCREATICÆ* are several small Rami sent by the *Splenica* to the Pancreas, along its inferior Side. There are other small pancreatic Veins that do not arise from the *Splenica*.

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The LEFT GASTRIC or GASTRO-EPIPLOÏC VEIN arises from the Splenica at the left Extremity of the Pancreas; whence it runs to the great Extremity of the Stomach, and along the great Curvature, till it meets the Gastrica Dextra, which is continuous with the Sinistra.

In its Passage it gives several Rami to both Sides of the Stomach, which are distributed by numerous Ramifications, form many Areolæ, and communicate with the Rami of the Coronaria Ventriculi.

At a small Distance from its Origin, this gastric Vein sends out a Ramus, which is distributed to the Omentum; and, on this Account, it has been called GASTRO-EPIPLOÏCA. This Ramus seems to communicate with the Hæmorrhoidalis Interna.

The VENA EPIPLOÏCA SINISTRA arises at the small Extremity of the Pancreas, and is ramified on the Omentum all the way to the Colon, where it communicates with the Hæmorrhoidalis Interna. When this Vein is wanting, the Ramus of the left Gastrica supplies its Place. It sometimes comes from the most anterior Ramus, which the Splenica sends to the Spleen.

Lastly, The VENA SPLENICA reaches the Fissure of the Spleen, which it enters, thro' its whole Length, by several Rami, almost in the same Manner as the splenic Artery. It is from the most posterior of these Rami that the Veins are sent off to the Extremity of the Stomach, formerly known by the Name of VASA BREVIA, which communicate with the Coronaria Ventriculi and Gastrica Sinistra.

The VENA HÆMORRHOÏDALIS INTERNA, or MESARAÏCA MINOR, is one of the three great Rami of the Vena Portæ, coming generally from the Beginning of the Vena Splenica, but sometimes

times from the Extremity or Angle of the Bifurcation of the great Trunk of the Vena Portæ.

At a small Distance from its Beginning it gives to the Duodenum a second *VENA DUODENALIS*, which is sometimes more considerable than the first; or that which comes from the great Trunk of the Vena Portæ.

Afterwards it is divided into two *Rami*, one superior or ascending, the other inferior or descending. The first runs to the superior Part of the Curvature of the Colon, where, after many Ramifications, it communicates with a Ramus of the *Mesaraica Major*, the Ramifications of the *Gastro-Epiploica Sinistra*, and those of the adjacent *Epiploica*.

The inferior Ramus descends on the left Portion of the Colon, on the inferior Incurvations of that Intestine, and on the Rectum, to the Anus. In this Course it supplies the Meso-colon, and forms Curvatures, that send out numerous small Ramifications which surround these Intestines: It likewise seems to communicate, by some capillary Twigs, with the left spermatic Vein.

☞ This Vein has been named *HÆMORRHOÏDALIS*, from the Tumors, often found at its Extremity next the Anus, which are called *HÆMORRHOÏDES*. The Word *INTERNA* is added to distinguish this Vein from the *HÆMORRHOÏDALIS EXTERNA*, which comes from the Vena Hypogastrica, and with which this Vein communicates by capillary Ramifications. The Name of *MESARAIÆA MINOR* agrees to it very well, because of its Situation with respect to the inferior mesenteric Artery, which is also less than the superior. *WINSLOW.*

The *Hæmorrhoid Vein*, as it lies under the Intestines, renders it liable to be compressed, and, consequently, retards the returning of the Blood; whence those Tumors named *Hæmorrhoids* are caused; which Disorders are more incident not only to the Branches which ramify on the Intestinum Rectum, but also the rest of the Vena Portæ, as it has no Valves to facilitate the Ascent of the Blood. Therefore it is no Wonder, that, when the Branches of the Vena Portæ which enter the Liver, and this Viscus, are obstructed, that then Patients are also subject to the Dropsy and Ascites; and Women, when with Child, are more subject to hæmorrhoidal Disorders than at other Times.



LECTURE XXII.

NEUROLOGY of the NERVES*.

BY the Assistance of Injections and Microscopes, wonderful Plexuses of sanguiferous Vessels are discovered to go from the PIA MATER into the CORTEX, cineritious or ash-coloured Part of the CEREBRUM, CEREBELLUM, and MEDULLA SPINALIS; whereas we can only see longitudinal Vessels, without numerous Ramifications, or reticular Plexuses, in the white medullary Substance of these Parts.

The Continuity of the Cortex with the Medulla of the Encephalon and spinal Marrow is observable with the naked Eye, but more distinctly seen with the Assistance of a Microscope.

In dissecting the Cerebrum and Cerebellum, we see the small Beginnings of the Medulla proceeding from the Cortex, and can trace its gradual Increase by the Addition of more Medulla coming from the Cortex.

The Cortex and Medulla are very succulent; for, being exposed to the Air to dry, they lose more of their Weight than most other Parts of the Body do.

* This Account of the Nerves is taken from Professor MONRO.

In several Places we can observe the Medulla to be composed of Fibres laid at each others Sides.

The medullary Substance is all employed in forming the white fibrous Cords which have now the Name of NERVES appropriated to them. Within the Cranium we see the Nerves to be the medullary Substance continued, and the Medulla Spinalis is all employed in forming Nerves.

The common Opinion concerning the Rise of the Nerves, founded on a superficial Inspection of those Parts, is, that the Nerves are propagated from that Side of the Encephalon at which they egress from the Cranium: But it having been remarked, after a more strict Enquiry, and preparing the Parts by Maceration in Water, that the medullary Fibres decussate or cross each other in some Parts of the Medulla; for Example, at the Corpus Annulare, and Beginning of the Medulla Spinalis: And practical Observators having related several Examples of People whose Brain was hurt on one Side, while the morbid Symptom, Palsy, appeared on the other Side of the Body, of which I have seen two Instances; and Experiments made on Brutes having confirmed these Observations, it has been thought, that the Nerves had their Rise from that Side of the Encephalon which is opposite to their Egress from the Cranium.

It may, however, still be said, that this last Opinion is not fully demonstrated, because a Decussation in some Parts is not a Proof that it obtains universally; and if there are Examples of Palsy of the Side opposite to where the Lesion of the Brain was, there are also others, where the Injury done to the Brain and the Palsy were both on the same Side.

The Nerves are composed of a great many Threads lying parallel to each other at their Exit from the Medulla.

This fibrous Texture is evident at the Origin of most of the Nerves within the Cranium; and in the Cauda Equina of the Medulla Spinalis we can divide them into such small Threads, that a very good Eye can scarce perceive them: But these Threads, when looked at with a Microscope, appear each to be composed of a great Number of smaller Fibrillæ.

How small one of these Fibrils of the Nerves is, we know not; but, when we consider that every, even the most minute Part of the Body is sensible, and that this must depend on the Nerves (which, all conjoined, would not make a Cord of an Inch Diameter) being divided into Branches or Filaments, to be dispersed thro' all these minute Parts; we must be convinced, that the nervous Fibrils are very small.

From the Examination of the Minimum VISIBLE it is demonstrated, that each Fibre in the Retina of the Eye, or expanded optic Nerve, cannot exceed the Size of the 32400th Part of a Hair.

The medullary Substance, of which the nervous Fibrils are composed, is very tender, and would not be able to resist such Forces as the Nerves are exposed to within the Bones, nor even the common Force of the circulating Fluids, were not the Pia Mater and Tunica Arachnoïdes continued upon them; the former giving them Firmness and Strength, and the latter furnishing a cellular Tunic to connect the Threads of the Nerves, to let them lie soft and moist, and to support the Vessels that go with them.

It is this cellular Substance that is distended with Air, when forced thro' a Blow-pipe thrust into a Nerve, and that makes a Nerve appear all
spongy,

spongy, after being so distended till it dries, the proper nervous Fibrils shrivelling so in drying, that they scarce can be observed.

These Tunics would not make the Nerves strong enough to bear the stretching and Pressure they are exposed to in their Course to the different Parts of the Body; and therefore where the Nerves go out at the Holes in the Cranium and Spine, the Dura Mater is closely wrapped round them, to collect their disgregated Fibres into tight firm Cords: And that the Tension, which they may happen to be exposed to, may not injure them, where they have not this additional Tunic, this strong Membrane is firmly fixed to the Sides of the Apertures in the Bones thro' which they pass.

The nervous Cords thus composed of nervous Fibrils, cellular Tunic, Pia and Dura Mater, have such numerous Blood-vessels bestowed on them, that after their Arteries only are injected, the whole Cord is tinged; and if the Injection is pushed too violently, the cellular Substance of the Nerves comes to be distended with it.

A nervous Cord, such as has been before described, has very little Elasticity, if compared with several other Parts of the Body. When cut out of the Body, it does not become observably shorter, while the Blood-vessels contract three Eighths of their Length.

The Nerves, in their Course to the several Parts of the Body, are generally lodged in a cellular or fatty Substance, and run in the Interstices of the Muscles, and other active Organs. Thus they are carefully guarded from the Pressure of these Parts, and the consequent bad Effects of such Pressure is prevented.

The larger Cords of the Nerves divide into Branches as they go off to the different Parts; the Branches being smaller than the Trunk from which they come, and making generally an acute Angle where they separate.

In several Places different Nerves unite into one Cord, which is commonly larger than any of the Nerves that form it.

Several Nerves, particularly those which are distributed to the Intestines, after such Union, suddenly form a hard Knot, considerably larger than all the Nerves of which it is made. These Knots were called CORPORA OLIVARIA, and are now generally named GANGLIONS.

The Ganglions have thicker Tunics, more numerous and larger Blood-vessels, than the Nerves; so that they appear more red and muscular. On dissecting the Ganglions, Fibres are seen running longitudinally in their Axes, and other Fibres are derived from their Sides in an oblique Direction to the longitudinal ones.

The Nerves that go out from the Ganglions are no way remarkably different from other Nerves.

The Nerves sent to the Organs of the Senses lose there their firm Tunics, and terminate in a pulpy Substance.

The OPTIC NERVES are expanded into the soft tender Webs of the Retina; the AUDITORY NERVE has scarce the Consistence of Mucus in the Vestibulum, Cochlea, and semi-circular Canals of each Ear; the Papillæ of the Nose, Tongue, and Skin, are very soft.

The Nerves of Muscles can likewise be traced till they lose their Tunics, and become very soft; from which, and what we observed of the sensory Nerves, there is Reason to conclude, that the MUSCULAR NERVES are also pulpy at their Ter-

minations, which we cannot indeed prosecute by Dissection.

It would seem necessary that the Extremities of the Nerves should continue in this soft flexible State, in order to perform their Functions right : For, in Proportion as Parts become rigid and firm by Age, or any other Cause, they lose of their Sensibility, and the Motions are more difficultly performed.

Tho' the Fibres in a nervous Cord are firmly connected, and frequently different Nerves join into one Trunk, or into the same Ganglion ; yet the Sensation of each Part of the Body is so very distinct, and we have so much the Power of moving the Muscles separately, that, if the Nerves are principal Agents in these two Functions, which I shall endeavour to prove they are ; we have Reason to believe, that there is no Union, Confusion, or immediate Communication, of the proper nervous Fibrils, but that each Fibre remains distinct from its Origin to its Termination.

Changes produced any way upon the Tunics of the Nerves, cannot, however, miss to affect the nervous Fibrils. The cellular Substance may be too full of Liquor, or may not supply enough ; the Liquor may not be of a due Consistence, or it may be preternaturally obstructed and collected. The Pia Mater may be too tense, or too lax ; as may ; also, the Dura Mater : their Vessels may be obstructed ; their proper Nerves may be violently irritated, or lose their Power of acting ; and a great many other such Changes may happen which will not only occasion Disorders in particular Nerves, but may cause the Sympathy, so frequently observed among the Nerves, which is so necessary to be attentively regarded in a great many Diseases, in order to discover their true State and Nature, without the Knowledge of which we

must

must commit very dangerous Mistakes in the Practice of Physic and Surgery.

Many Experiments and Observations concur in proving, that, when the Nerves are compressed, cut, or any other way destroyed, the Parts served by such Nerves farther from the Head or Spine than where the injuring Cause has been applied, have their Sensations, Motions, and Nourishment, weakened, or lost; while no such Effects are seen in the Parts nearer to the Origin of those Nerves: And in such Experiments where the Cause impeding the Nerves to exert themselves could be removed, and the Structure of the Nerves not injured; for Example, when a Ligature made upon a Nerve and stopping its Influence has been taken away, the Motion and Sensation of the Parts soon were restored.

From which it would appear, that the Nerves are principal Instruments in our Sensations, Motions, and Nourishment; and that this Influence of the Nerves is not inherent in them without the Communication between these Cords, and their Origin is preserved.

It will be no Objection to this Conclusion, that sometimes, upon cutting a Nerve, the Effects above mentioned have been felt for a short Time, but afterwards the Person was sensible of no Numbness or Immobility: For wherever this is said to have happened, the cut Nerve was only one of several which were sent to the Member, the Want of whose Influence was felt no longer than till the Habit was acquired of performing the Functions easily by the other Nerves.

It is of no greater Weight as an Objection, than, when a Ligature is drawn very hard upon a Nerve, that it never again recovers its Influence upon the Parts it is distributed to beyond the Ligature, but is of as little Effect as if it had

been cut through; which is to say, that its Texture has been altered beyond Recovery. The same Thing is to be seen by tying a Thread tight round a tender Twig of any Vegetable, it decays.

Experiments and Observations shew too, that when Parts of the Encephalon or Medulla Spinalis have been irritated, compressed, or destroyed; the Parts of the Body, whose Nerves had their Origin from such affected Parts of the Encephalon or Medulla Spinalis, became convulsed, paralytic, insensible, or wasted: And in such Cases where the injuring Cause could be removed from the Origin of the Nerves, the morbid Symptoms, observed in the Parts to which these Nerves were distributed, went off upon the Removal of that Cause. From which it is thought reasonable to conclude, that the Nerves must not only have a Communication with their Origin, but that the Influence they have upon the Parts they are distributed to, depends on the Influence which they derive from the Medulla Encephali and Spinalis.

Tho' the Medulla Spinalis has its own Vessels and cineritious Substance which assists to form its Medulla; yet a very large Share of the medullary Substance within the Spine is derived from the Encephalon, whose Medulla Oblongata descends from the Head, and the Influence of the Medulla Spinalis on its Nerves depends in a great measure on this Medulla Oblongata of the Head. Hence an Injury done to any Part of the Medulla Spinalis, immediately affects all the Parts whose Nerves have their Origin below where the injuring Cause is applied to the spinal Marrow. A Luxation of a Vertebra in the Loins makes the inferior Extremities soon paralytic; a transverse Section of the Medulla at the first Vertebra of the Neck soon puts an End to Life.

If such Causes produce constantly such Effects in us and other Creatures living in nearly the same Circumstances as we do, the Conclusions already made will be good, notwithstanding Examples of Children and other Creatures being born without a Cerebrum or Medulla Spinalis; or notwithstanding the Cerebra of adult Creatures, being much changed in their Texture by Diseases; and notwithstanding Tortoises, and some other Animals, continue to move about a considerable Time after their Heads were off.

We may be ignorant of the particular Circumstances requisite or necessary to the being or well-being of this or that particular Creature, and we may be unable to account for a great many Phænomena; but we must believe our Eyes in the Examination of Facts; and if we see constantly such Consequences from such Actions, we cannot but conclude one to be the Cause, and the other the Effect.

It would be as unjust to deny the Conclusions made in some of the preceding Articles, because of the seeming preternatural Phænomena mentioned in this Article, as it would be to deny the Necessity of the Circulation of the Blood in us and Quadrupedes, because a Frog can jump about, or a Tortoise walk longer after all the Viscera of its Thorax and Abdomen are taken out; or because the different Parts of a Worm crawl after it has been cut into a great many Pieces.

It is therefore almost universally agreed, that the Nerves are principal Instruments in our Sensations and Motion; and that the Influence which they have is communicated from their Origin, the Encephalon, and Medulla Spinalis: But Authors are far from agreeing about the Manner in which this Influence is communi-

cated, or in what Way Nerves act to produce these Effects.

Some alledge, that the nervous Fibres are all solid Cords acting by Elasticity or Vibration: Others affirm, that those Fibres are small Pipes conveying Liquors, by means of which all their Effects are produced.

Those who think the nervous Fibres solid, raise several Objections to the other Doctrine, which I shall consider afterwards, and endeavour to shew the Fitness of their own Doctrine to account for the Effects commonly observed to be produced by the Nerves.

The Objects of the Senses plainly, say they, make Impulses on the Nerves of the proper Organs, which must shake the nervous Fibrils, and this Vibration must be propagated along the whole Cord to its other Extremity or Origin, as happens in other tense Strings; and these Vibrations being differently modified according to the Difference of the Object, and its different Application, produce the different Ideas we have of Objects.

To this Account of the Sensations it is objected, 1. That Nerves are unfit for Vibrations; because their Extremities, where Objects are applied to them, are quite soft and pappy, and not susceptible of the Vibrations supposed: And if there could be any little Tremor made here by the Impulse of Objects, it could not be continued along the nervous Cord, because the cellular Substance, by which each particular Fibre is connected to the adjacent ones, and the fatty Substance in which the nervous Cord is immersed, would soon stifle any such vibratory Motion.

The 2d Objection to this Doctrine is, That, supposing the Nerves capable of Vibrations by the Impressions of Objects, these Vibrations would
not

not answer the Design. For if what we know of other vibrating Strings, to wit, that their Tone remains the same, unless their Texture, Length, or Tension, is altered; and that different Substances striking them do no more than make the Sound higher or lower: If these Properties are to be applied to Nerves, then it will follow, that the same Nerve would constantly convey the same Idea, with no other Variety than of its being weaker or stronger, whatever different Objects were applied to it; unless we suppose the Nerve changed in its Texture, Length, or Tension, each Time a different Object is applied, which, it is presumed, no Body will undertake to prove does happen.

But farther; If ever such a Variety of Vibrations could be made, our Sensations would, notwithstanding, be confused and indistinct, because the tremulous nervous Fibre, being firmly connected, and contiguous to several other Fibres of the same Cord, would necessarily shake them too; by which we should have the Notion of the Object as applied at all the different Parts where the Extremities of these Fibres terminate.

In whatever Way the Favourers of the Doctrine of solid Nerves please to apply the Elasticity of Nerves to the Contraction of Muscles, their Adversaries insist, that Nerves are too weak to resist such Weights as the Muscles sustain; they would surely break, especially as they are in a great measure, if not wholly, deprived of their strong Tunics before they come to the Part of the Muscle they are immediately to act upon; and the Nerves being found to have little or no Elasticity to shorten themselves, shew them altogether unfit for such an Office as this of contracting Muscles in the Way proposed of their acting by Elasticity.

As a farther Objection against either Motion or Sensation being owing to the Elasticity of the Nerves, it is said, that if this Doctrine was true, the Sensations would be more acute, and the Contractions of Muscles would be greater and stronger when the Parts become firmer and more rigid by Age; for then their Elasticity is increased: Whereas, on the contrary, it appears, that then the Sensations are blunted, and muscular Contraction becomes less, and weaker.

If the Nerves were granted to be elastic, and to communicate a springy Force to all the Parts they are distributed to, they might appear necessary, in this View, to assist the Application of the nutritious Particles of the Fluids to the Sides of the Vessels which these Particles were to repair, and so far might well enough account for the Share which Nerves are thought to have in Nutrition: Yet, if we cannot make Use of Elasticity in the other two Functions of Sensation and Motion, we must also endeavour to find out some other Way for the Nerves to act in Nutrition, which will be done afterwards.

Having thus stated the Reasons for and against the Nerves acting as solid Strings, let us likewise relate the Arguments for Nerves being Pipes, and the Objections to this Doctrine.

A great Argument of those who think the Nerves to be Tubes conveying Liquors is, the strong Analogy of the Brain and Nerves to other Glands of the Body and their Excretories, where a manifest Secretion of Liquor is made in the Glands to be conveyed by the Excretories to the proper Places in which it ought to be deposited: They think, that the vascular Texture of the Cortex of the Encephalon and Medulla Spinalis; the Continuation of the Cortex in forming the medullary Substance; the fibrous Texture and succulent

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State of this Medulla, and its being wholly employed to form the Nerves, where the fibrous Texture is evident; all these Things, say they, conspire to shew such a strong Analogy between these Parts and the other Glands of the Body, as carries a Conviction that there is a Liquor secreted in the Encephalon and Medulla Spinalis, to be sent out by the Nerves to the different Parts of the Body.

The following Objections are raised to this Argument in Favour of a Liquor conveyed in the Nerves, from the Analogy of the Glands.

1. Other Glands, it is said, have their Excretories collected into a few large Pipes, and not continued in such a great Number of separate Pipes, as far as the Places where the Liquors are deposited, which last must be the Case, if the Nerves are the Excretories of the glandular Brain.

2. We see the Cavities, and can examine the Liquors in the Excretories of other Glands much smaller than the Brain, which cannot be done in the Nerves.

3. If the Nerves were Pipes, they would be so small, that the Attraction of the Liquors to their Sides would prevent that Celerity in the Motion of the Liquors, which is requisite to Sensations and Motions.

4. If the Nerves were Pipes, they would be cylindrical ones, and, consequently, not subject to Diseases; or, at least, we could have no Comprehension of the Diseases in them.

The Answer to the 1st of these Objections is, That there are other Glands where there is a manifest Secretion, and in which the Disposition of the Excretories is in much the same Way as in the Encephalon: The Kidneys, for Example, have a reticulated Cortex of Vessels, from which the Eustachian or Bellinian Medulla, consisting of
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longitudinal Fibres and a few Blood-vessels in the same Direction proceeds; and this Medulla is collected into ten or twelve Papillæ, each of which is formed of numerous small separate Pipes, which singly discharge the Urine into the large membranous Tubes, and these united form the Pelvis. Upon comparing this Texture of the Kidney with that of the Encéphalon, the Analogy will be found very strong.

In Answer to the 2d Objection it is granted, that Microscopes, Injections, and all the other Arts hitherto employed, have not shewn the Cavities of the nervous Fibrils, or the Liquors contained in them; and from what was said of the Smallness of the nervous Fibrils, it is not to be expected that ever they should be seen: But so long as such a Number of little Animals can every Hour be brought to the Objectors, in which they can as little demonstrate the Vessels or contained Fluids, it will not be allowed to be conclusive Reasoning, that, because ocular Demonstration cannot be given of either Tubes, or their Contents, therefore they do not exist. For if we have any Notion of an Animal, it is its being an hydraulic Machine, which has Liquors moving in it as long as it has Life: If, therefore, such little Animals have Vessels and Liquors which we cannot see, why may not some of the Vessels and Liquors of the human Body be also invisible to us?

To avoid this Answer to the Objection, it is farther urged, That tho' we might not see the nervous Tubes, or the Liquors they contain, as they naturally flow; yet, if such Liquors really exist, they ought to discover themselves, either by a Nerve's swelling when it is firmly tied; or that, however subtil their Fluids are, they might be collected in some Drops, at least, when the cut

End

End of a Nerve of a living Animal is kept some Time in the exhausted Receiver of an Air-Pump. It is affirmed, that neither did the tied Nerve swell between the Brain and Ligature, nor was there any Liquor collected in the Receiver of the Air-Pump; from which it is concluded, that there is no Liquor in the Nerves.

There is some Difference among those who say they have tried these Experiments; some affirming, that in young Animals the Nerve does swell above the Ligature, and that a Liquor does drill out upon cutting a Nerve.

But allowing the Experiments to succeed any way, the Reply to the Inference from them is, that in neither way are they any Thing to the Purpose: For the swelling of the Nerve after it is tied, or the Efflux of Liquors from its Extremity, will never prove either to be the Effect of the Fluid in the proper nervous Fibrils, so long as they might be occasioned by the Liquors in the larger Vessels of the cellular Substance of the Nerves; and if these same Vessels of the Tunics of the Nerves do not discover their Liquors by these Experiments, it is far less to be expected that the much more subtil Nerves should.

The 3d Objection to the Doctrine of the Brain being a Gland, and the Nerves its Excretories, supposes a more rapid Motion necessary in the Fluid of the Nerves, than what most of the Defenders of the nervous Fluid will now allow, and is afterwards to be considered particularly in a more proper Place.

The 4th Objection being, That if Nerves are Excretories of a Gland, they must be cylindrical Pipes, in which no Obstructions or Diseases would happen; but since we daily see Diseases in the Nerves, they must therefore not be such Excretories. The Answer is, That Diseases happen
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often in the Excretories of other Glands, as of the Liver, Kidneys, &c. notwithstanding their cylindrical Form, and their much shorter and less exposed Course. When we consider the very tender Substance of the Brain, the vast Complication of Vessels there; the prodigious Smallness of the Pipes going out from it; the many moving Powers which the Nerves are to undergo the Shock of, and the many Chances which the Vessels, Membranes, and cellular Substance accompanying the Nerves, have of being disordered, and then affecting the nervous Fibrils; we have very great Reason to be surpris'd, that these cylindrical Pipes are not much more frequently put out of Order by too great or too small a Quantity of Liquors; by too viscid or too thin Fluids; by Liquors consisting of too mild and sluggish Particles, or of too acrid pungent ones; by too great or too little Motion given to the Liquors; by the Diameters of the Pipes being too much streightened, or too much enlarged; and by a great many other Varieties of Circumstances which might be supposed capable of disturbing the Functions of the Nerves, supposing them to be cylindrical Excretories of the Gland the Brain.

The numerous Vessels of the Encephalon have brought some of the Gentlemen, who assert the Nerves to be solid, to acknowledge, that there is a Liquor secreted in the Brain: But, then, they will not allow that this Liquor is sent out by the proper nervous Fibrils, but that it is poured into the cellular Substance in which the Nerves lie, to keep them moist and supple, and therefore fit for exerting their Elasticity, Vibration, &c. by which, in their Opinion, the Effects, commonly ascribed to Nerves, are produced.

Besides the Objections already mentioned against the Nerves acting as elastic Strings, this Opinion
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has some other Difficulties which may be objected to it. For instance; there is not one analogous Example in the whole Body of Liquors secreted in a large Gland to be poured into a cellular Substance, as is here supposed; the Liquors in the Cells of the Tunica Cellularis of other Parts are separated from the little Arteries which are distributed to these Cells.

Farther: It cannot be well determined, how a Liquor secreted in the Cortex of the Brain should make its Way, thro' the Medulla, to come out into the cellular Membranes on the Surface of that Medulla.

Lastly, A very simple Experiment of injecting Water by the Artery of any Member, and thereby filling the cellular Substance of the Nerves of that Member, shews evidently, that the Liquor of the Tunica Cellularis of the Nerves has the same Fountain as the Liquor in the Tunica Cellularis has any-where else; that is, from the little Arteries dispersed upon it.

The Doctrine of a Fluid in the Nerves is not only thus supported by the Analogy of the Brain and Nerves to the other Glands, and their Excretories; but those who maintain this Doctrine mention an Experiment which they think directly proves a Fluid in the Nerves. It is as follows:

After opening the Thorax of a living Dog, catch hold of, and press, one or both the phrenic Nerves with the Fingers; the Diaphragm immediately ceases to contract: Cease to compress the Nerves, and the Muscle acts again. A second Time lay hold of the Nerve or Nerves some way above the Diaphragm, its Motion stops: Keep firm the Hold of the Nerve, and with the Fingers of the other Hand strip it down, from the Fingers which make the Compression, towards the Diaphragm, and it again contracts; a Repetition
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of this Part of the Experiment three or four Times, is always attended with the same Effects; but it then contracts no more, strip as you will, unless you remove the Pressure to take hold of the Nerves above the Place first pinched, when the Muscle may again be made to contract, by stripping the Nerve down towards it. This Experiment I have done with the Success here mentioned.

Let any one try if he can imagine any other reasonable Account of these Appearances, than that the Pressure by the Fingers stopped the Course of a Fluid in the Nerve; that so much of this Fluid as remained in the Nerve, betwixt the Fingers and Diaphragm, was forced into that Muscle by stripping; and when it was all pressed away, the Fingers above preventing a Supply, the Muscle contracted no more till the Fingers were removed, and a fresh Flow, by that means, was received from the spinal Marrow, or from that Part of the Nerve which had not yet been so stripped.

Some Gentlemen, convinced of the Reasonableness of the Secretion of a Liquor in the Brain to be sent out by the Nerves, but not comprehending how a Fluid could have such a rapid retrograde Motion as they imagined was necessary for conveying the Impressions of Objects made on the Extremities of Nerves to the Sensorium, supposed two Sorts of Nerves; one that conveyed a Liquor for muscular Motion and Nutrition, the other composed of solid Nerves, that were to serve for the Organs of the Senses, to convey the Vibrations communicated from Objects to the Sensorium.

To this Opinion the Objections against the sensory Nerves acting by Vibration may be made; and there is so little Reason to suspect any Difference

ence in the Texture of the Brain or Nerves, that, on the contrary, the Structure is every where similar, and Branches of the same Nerve often serve both for Sensation and Motion.

How little Necessity there is for supposing extremely rapid Motions of the nervous Fluid, is to be examined soon.

The Hypothesis of great Celerity in the Motion of the Fluid of the Nerves being necessary, gave also Rise to another Division of the Nerves into arterious, or effluent; and venous, or refluent. It was said, that muscular Motion and Nutrition depended on the arterious Nerves, and that the Sensations depended on an accelerated Motion of the nervous Fluid towards the Brain, by the Impressions which the Objects of the Senses make upon the venous Nerves.

By this Supposition the Absurdity of rapid Fluxes and Reflexes in the same Canal was prevented, and an Advantage was thought to be gained by it, of saving too great a Waste of the Fluid of the Nerves, which otherwise the Encephalon and Medulla Spinalis could not supply sufficient to answer all the Exigencies of Life.

To this Opinion it has been objected, 1. That there is no Example in the Body of a secreted Liquor being returned immediately and unmixed to the Gland by which it was originally separated from the Mass of Blood, which would be the Case were there venous Nerves.

2. There is no Occasion for saving the Fluid of the Nerves in the Way proposed, the Organs for secreting that Fluid being large enough to supply all that is necessary of it in the common Functions of Life.

3. If the Fluid of the Nerves was to be thus kept in a perpetual Circulation, it would soon become too acrid for continuing with Safety in such
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sensible tender Vessels as the Brain and Nerves are composed of.

4. This Hypothesis will not answer the Design for which it was proposed. For though the momentary Application of an Object might cause an Acceleration in the Fluid of venous Nerves; yet, if the Object was kept applied to the Nerves, it would stop their Fluid, so that it could not go forwards to the Brain: And therefore, according to this Doctrine, we should be sensible of no Objects, except those whose Application to the Organs of the Senses was momentary.

Let us now suppose it probable, that the Encephalon and Medulla Spinalis secern a Liquor from the Blood which is sent into all the Nerves, and that, by means of this Liquor, the Nerves perform the Offices commonly assigned to them; it is next necessary to enquire what Kind of Liquor this is, and how it moves, in order to determine how well its Nature and Motion are fitted for performing what is expected from it.

The Liquor of the Nerves has been fancied by some to be of a very strong acid or alkaline Nature: But since none of our Juices appear to be of this Sort, and since such Liquors irritate and destroy the Parts of the Body which they are applied to; we cannot conceive how the Brain can separate, or the Nerves could bear any Thing of such an acrid Nature: This Tenderness and Sensibility of these Organs must hinder us absolutely from supposing that the Liquor of the Nerves can be acrid or pungent, or of the Nature of Spirit of Wine, Hartshorn, &c.

Some have imagined the Liquor of the Nerves to be capable of vast Explosion, like Gunpowder; or of violent sudden Rarefaction, like Air; or of strong Ebullition, like boiling Water, or the Mixture of Acids with alkaline Liquors. But as the

Mass

Mass of Blood, from which this Fluid is derived, is not possessed of any such Properties; we cannot suppose the Blood to furnish what it has not in itself. Besides, all these Operations are too violent for the Brain or Nerves to bear; and, when once they are begun, are not so quickly controlled, or restrained, as Experience teaches us the Nerves can be made to cease from acting.

We are not sufficiently acquainted with the Properties of an Æther pervading every Thing, to apply it justly in the Animal Oeconomy; and it is as difficult to conceive how it should be retained in a long nervous Cord, as it is to have any Idea how it should act: These are Difficulties not to be surmounted.

The surest Way of judging what Kind of Liquor this of the Nerves must be, is, to examine the Liquors of similar Parts of the Body. All the Glands separate Liquors from the Blood much thinner than the compound Mass itself: Such is the Liquor poured into the Cavity of the Abdomen, Thorax, Ventricles of the Brain, Saliva, pancreatic Juice, Lymph, &c. Wherever there is Occasion for secreted Liquors being thick and viscid, in order to answer better the Uses they are intended for, Nature has provided Reservoirs for them to stagnate in, where their thinner Parts may be carried off by the numerous absorbent Veins dispersed on the Sides of those Cavities, or they may exhale where they are exposed to the open Air.

The Mucus of the Nose becomes viscid by Stagnation; for when it is immediately secreted, it is thin and watery, as appears from the Application of Sternutatories, &c. The Cerumen of the Ears is of a watery Consistence, when just squeezed out. The Mucus of the alimentary Canal grows thick in the Lacunæ. The Bile in the hepatic

Duct has little more Consistence than Lymph; that in the Gall-bladder is viscid, and strong. The Urine is much more watery, as it flows from the Kidneys, than when it is excreted from the Bladder. The Semen is thin, as it comes from the Testicles, and is concocted in the Vesiculæ Seminales, &c.

Hence we may safely conclude, that a thin Liquor is secreted in the Cortex Encephali and Medulla Spinalis: And seeing that the Thinness of secreted Liquors is generally as the Divisions of the Vessels into small subtil Branches, and that the Ramifications within the Cranium are almost infinitely subtil; the Liquor secreted in the Encephalon may be determined to be among the finest or thinnest Fluids.

Seeing, also, that we can observe no large Reservoir, where the Liquor secreted in the cortical Substance is deposited, to have its finer Parts taken off; we have Reason to think, that it goes forwards into the Nerves in the same Condition in which it is secreted.

By fine or subtil animal Liquors, is meant no more than those which are very fluid, and which seem to consist of a large Proportion of aqueous Particles, and a lesser one of the oleous, saline, and terrestrial Particles. Some of the Liquors which we can have in sufficient Quantity to make Experiments with, are so fluid, and have so little Viscidity or Cohesion of Parts, that, when laid on a Piece of clean Mirrour, they will evaporate without leaving a Stain: Such is the Liquor oozing out from the Surface of the Pleura, Lymph, and several others.

If, then, these Liquors, which are subject to our Examination, the secreting Vessels of which are so large that we can see them, have such a small Cohesion of Parts; it might not be unreasonable

to say, that the Liquor of the Nerves is as much more fine and fluid than Lymph, as the Vessels separating it are smaller; and therefore that the Fluid of the Nerves is a defecated Water, with a very small Proportion of the other Principles extremely subtilized.

Two Experiments are said to contradict this Opinion of the Liquor of the Nerves being so fluid and subtil. One is, That, upon cutting the Cauda Equina of a living Animal, a Liquor, as viscid as the White of an Egg, drops out: The other is, That a wounded Nerve yields a glairy Sanies. But these do not appear to be the proper Fluid of the Nerves, since it is evident, that what is discharged, in both these Cases, comes out of the cellular Substance involving the nervous Fibrils.

Considering how many Experiments make it evident, that there is a constant uninterrupted Stream of Liquors flowing through all the Canals of Animals, which convey Liquors, whose Particles are smaller than the Diameter of their Canal; which is always the Case in a natural State; it is surprising how it ever could be thought that the Liquid of the Nerves should be obliged to flow from the Brain to each Muscle the Moment we will; or that this Liquor should flow back with the like Swiftneſs from the Extremity of each Nerve, to which an Object of Sensation was applied.

The Nerves, as well as the other Excretories of the Glands, are always full of Liquors, the Degree of Distension of the Canals not being always alike even in a sound State: But this happens without Inconvenience, as the Sides of the Canals have a Power to accommodate themselves to the present Quantity, unless it is very large, or

considerably diminished; in both which Cases, Diseases ensue.

The Motion of the Fluid in the Nerves will not only then be constant, but it will also be equal, or nearly so. For tho' the Blood in the larger Arteries is moved unequally by the unequal Forces, the Contraction of the Ventricle of the Heart, and the weaker Power, the Systole of the Arteries; yet the Difference between these two moving Powers comes to be less and less perceptible, as the Arteries divide into smaller Branches, because of the numerous Resistances which the Liquors meet with, and because the Canals they move in become larger, till in the very small arterious Branches there is no Difference in the Velocity of the Liquors from the Effect of the Heart or Arteries. The Motion of the Fluids must still be more equal in the Excretories of Glands, and particularly in those where the Vessels have divided into very minute Branches. So that the nervous Fluid will move constantly, equally, and slowly, unless when its Course is altered by the Influence of the Mind, or by the Pressure of some adjacent active Organ.

We have perhaps no Idea of the Manner in which Mind and Body act upon each other; but if we allow that the one is affected by the other, and that the Fluid of the Nerves (whatever Name People please to give it) is a principal Instrument which the Mind makes Use of to influence the Actions of the Body, or to inform itself of the Impressions made on the Body, we must allow that the Mind can direct this Instrument differently, particularly as to Quantity and Celerity.

Let us now suppose the nervous Fluid such as has been argued for, that is, an extreme fluid saponaceous Water, moving in a constant, equal,
slow

flow Stream, from the Encephalon and Medulla Spinalis in each of the proper nervous Fibre, except when the Motion is changed by some accessory Cause, such as the Mind, Pressure of other Parts, &c. and let us examine how well such a Supposition will agree with the Phænomena of the three great Functions, Nutrition, Sensation, and muscular Motion, which the Nerves are principal Instruments of.

In general we may say, that Nerves can carry Fluids to the most minute Part of the Body, to supply what is wasted in any of the Solids; that the Impression made by the Objects of the Senses on the very soft pulpy Extremities of the Nerves of the Organs of the Senses, must make such a Stop in the equal-flowing nervous Fluid, as must instantaneously be perceptible at the Spring from which the Pipes affected arise, that the constant Flow of the Liquor of the Nerves into the Cavities of the muscular Fibrillæ, occasions the natural Contraction of Muscles, by the constant Nisus it makes to increase the transverse, and to shorten the longitudinal Diameter of each Fibre, and that it is only to allow the Mind a Power of determining a greater Quantity of this same Fluid with a greater Velocity, into what muscular Fibres it pleases, to account for the voluntary strong Action of Muscles.

But since such a superficial Account would not be satisfactory, it will be expected, that the principal Phænomena of these three Functions should be explained by the Means of such a Fluid as has been supposed, and that the several Objections against this Doctrine should be answered: Let us attempt this, and where we cannot extricate ourselves from Difficulties which may be thrown in, let us boldly acknowledge Ignorance.

If Water, with a very small Proportion of Oils and Salts from the Earth, proves a fit Nourishment for Vegetables, such a Liquor, as the Fluid of the Nerves has been described, may not be unfit for repairing the Waste in Animals.

The slow continual Motion of this nervous Fluid to the most minute Parts of the Body is well enough calculated to supply the Particles that are constantly wore off from the Solids by the Circulation of the Liquors and necessary Actions of Life.

The greater proportional Size of the Encephalon in young Creatures, than in Adults, seems calculated for their greater proportional Growth: For the younger the Animal is, the speedier Growth and larger Encephalon it has.

A Palsy and Atrophy of the Members generally accompanying each other, shew, that Nourishment, Sensation, and Motion, depend on the same Cause.

It has been said, that the Nerves were principal Instruments in Nutrition; but it was not affirmed that they were the sole Instruments; and therefore an Atrophy may proceed from the Compression or other Lesion of an Artery, without being an Objection to the Doctrine here laid down.

All Objects of Sense, when applied to their proper Organs, act by Impulse; and this Action is capable of being increased by increasing the impelling Force. In tangible Objects this is clearly evident: The closer they are pressed, to a certain Degree, the more distinct Perception ensues. Odorous Particles need the Assistance of Air moved rapidly, to affect our Noses; sapid Substances, that are scarce sufficient to give us any Idea of their Taste by their own Weight, are assisted by the Pressure of the Tongue upon the Palate: The Rays of Light collected drive light

Bodies before them: Sound communicates a Vibration to all Bodies in harmonic Proportion with it. The Impulse made thus by any of these Objects on the soft pulpy Nerves which are full of Liquor, will press their Sides or Extremities, and their Liquor will be hindered from flowing so freely as it did.

The Canals being all full, this Resistance must instantaneously affect the whole Column of Fluids in the Canals that are pressed and their Origins, and have the same Effect as if the Impulse had been made upon the Origin itself.

To illustrate this by a gross Comparison, Let any one push Water out of a Syringe thro' a long flexible Pipe, fixed to the Syringe, and he will be sensible of Resistance, or a Push backwards, the Moment any one stops the Orifice of the Pipe, or closes the Sides of it with his Fingers.

This Impulse made on the Nerves, and thus communicated to their Origin, will vary according to the Strength or Weakness, the Quickness or Slowness, the Continuance or speedy Removal, the Uniformity or Irregularity, the Constancy or Alteration, &c. with which Objects are applied to the Nerves.

Whenever any Object is regularly applied, with due Force, to a Nerve rightly disposed to be impressed by it, and is communicated, as just now explained, to the Sensorium; it gives a true and just Idea of the Object to the Mind.

The various Kinds of Impulses which the different Classes of Objects make, occasion a Necessity of having the different Organs of the Senses variously modified, so that the several Impulses may be regularly applied to the Nerves in each Organ; or, in other Words, we must have different Organs of the Senses fitted to the different Classes of Objects.

As the Objects have one common Property of Impulse, so all the Organs have most of the Properties of the Organ of Touching in common with the Papillæ of the Skin. In the Nose and Tongue this is evident; in some Operations on the Eyes we can also perceive this, as we may likewise do, in some Cases, where Matter is collected in the internal Ear.

These Properties, common to the Objects and the Organs, frequently occasion uncommon Effects in the Application of an Object to an Organ proper to another Object of Sensation: For sometimes we have the same Idea as if the Object had been applied to its own proper Organ; at other Times the Object is, as it were, changed; and we have the Idea as if the Organ had had its own proper Object applied to it.

Thus, for Example, Light is the proper Object to be applied to the Eye, to give us any Idea of Colours; yet, when all Light is excluded from the Eyes, an Idea of Light and Colours may be excited in us by Coughing, Sneezing, rubbing, or striking, the Eye-ball.

A Cane vibrating, but not so much as to give any Sound perceptible to the Ear, if it is applied to the Teeth, it raises a strong Idea of Sound; as will, also, a little Insect creeping in the Meatus Auditorius.

The Fingers applied to two rough Surfaces, rubbing on each other, are sensible of the Sound they make; Surgeons of any Practice, in the Cure of fractured Bones, can bear Witness to the Truth of this. The Fingers dipped in acid and several other acrid Liquors, have a Sensation very like to Tasting.

Smelling and Tasting, every Body knows, are subservient and assisting to each other.

From such Examples we have farther Proof of one general Cause of our Sensations, to wit, Impulse from the Objects; and of such a Similarity and Relation in the Organs, as might give Reason for imagining that any one of them would be capable of producing the Effect of another, if the Impulses of the different Objects could be regularly applied to each.

If the Impulse of an Object is applied with due Force, but irregularly, a confused Idea of the Object is raised. Distant Objects are confused to Myopes, as very near ones are to Presbytæ.

If the Application of the Impulse is regular, but the Force with which it is applied is too weak, our Perception of the Object is too faint. One may whisper so low as not to be heard.

If the Application of Objects is too violent, and there is any Danger of the tender Organs of our Senses being hurt or destroyed, the uneasy Sensation, we call Pain, is raised, whatever the Organ thus injured is. The Objects of Feeling affect every Organ: Thus Pressure, cutting, pricking Salts, pungent Oils, great Heat, violent Cold, &c. occasion Pain, wherever they are applied. Besides this, every particular Organ can be affected with Pain, by the too violent Application of its own proper Object. Too much Light pains the Eyes; very loud Sound stuns the Ears; very odorous Bodies, and too sapid Objects, hurt the Nose and Tongue: A pretty sure Proof this, that the Objects of our Senses all act, and that the Organs are all impressed in nearly the same Way.

Whenever this uneasy Sensation, Pain, is thus raised, a Sort of Necessity is, as it were, imposed upon the Mind, to endeavour to get free of the injuring Cause, by either withdrawing the grieved Part of the Body from it, as one retires his Hand when his Finger is pricked or burnt; or the in-
juring

injuring Cause is endeavoured to be forced from the Body, as a Tenesmus pushes acrid Fæces out of the Rectum. In both these Operations a convulsive Contraction is immediately made in the lesed Part, or in the Neighbourhood of it; and if the Irritation is very strong or permanent, the greater Part of the nervous System comes to be affected in that spasmodic or convulsive Way.

This Nifus of the Mind to free the Body of what is in Danger of being very hurtful, may serve to explain the Phænomena of a great many Diseases, when we are acquainted with the Distribution of the particular Nerves; and from this we can understand the Operation of Medicines that stimulate, and may learn how, by exciting a sharp but momentary Pain, we may free the Body of another Pain that would be more durable; and that, by having it thus in our Power to determine a Flow of the Liquor of the Nerves to any particular Part, for the Benefit of that Part, or the Relief of any other diseased Part, we can do considerable Service by a right Application of the proper Medicines.

If a Pain-giving Cause is very violent, or long continued, it destroys the Organs either irrecoverably, or puts them so much out of Order, that they only gradually recover. People have been made blind or deaf, for all their Lives after, by the violent Effect of Light on their Eyes, or of Sound on their Ears; and we are frequently exposed to as much Light and Sound as makes us unfit to see or hear for a considerable Time after.

I would explain this by a Ligature put round the tender Branch of an Herb: This Ligature, drawn to a certain Degree, may weaken the Canals so as to be unfit for the Circulation of the Juices a good While, till they are gradually explicated, and made firm, by these Juices. A stricter Li-

gature

gature would disorder the Structure of the Fibres so much, that the Liquors could not recover them. The Analogy is so plain, that it needs no Commentary.

In applying the Fluid of the Nerves to the Action of Muscles, it was said, that the natural or involuntary Contraction of Muscles was the Nîsus which the nervous Fluid, flowing constantly into the muscular Fibres, makes to distend these Fibrils, by enlarging their transverse Diameters, and shortening their Axes, and that voluntary Contraction was owing to a greater Quantity of that nervous Liquor determined towards the Muscle to be put in Action, and poured with a greater Momentum into the muscular Fibrils by the Power of the Mind willing to make such a Muscle to act.

It has been objected to this Account of muscular Motion, That, if it was true, the Volume of a Muscle in Contraction necessarily would be considerably increased by so much Liquor poured into its Fibrils; whereas it does not appear by any Experiment, that the Volume of a Muscle is increased by its being put into Action.

To this it has been answered, That the Spaces between the muscular Fibres are sufficient to allow the Fibrils swelling during the Contraction of a Muscle to lodge in, without any Addition to the Bulk of the Muscle; and that it plainly appears that these Spaces between the Fibrils are thus occupied, by the Compression which the larger Vessels of Muscles, which run in those Spaces, suffer during the Action of a Muscle; it is so great, that the Muscle becomes pale by contracting.

Another Objection to the Action of Muscles, being owing to the Influx of a Fluid into their Fibrils is, That muscular Fibres are distractile, or capable of being stretched; and therefore, when

a Fluid is poured into their hollow Fibrils, they would be stretched longitudinally, as well as have their transverse Diameters increased; that is, a Muscle would become longer, as well as thicker, when it is put in Action; whereas it is known to every Body, that a Muscle is shortened while it acts.

In Answer to this it has been remarked, that tho' muscular Fibrils are distractile, yet they will not yield to, or be stretched by, every Force, how ever small, that might be applied to them. A Cord that can be stretched in Length by the Weight of a Pound or two, would not yield in the least to an Ounce or two; and it must likewise be observed, that gradually as any Body is stretched, its Resistance to the stretching Force increases. A Rope may be stretched to a certain Length by a Pound Weight appended to it, which would require two Pounds to stretch it very little farther; and therefore the general Observation of animal Fibres being distractile, cannot be a reasonable Objection to the Account of muscular Motion above mentioned, unless a Proof is brought that the Force which the Liquid of the Nerves must exert upon each Fibre of a Muscle in order to make a Muscle act, is capable of distracting or stretching the Fibres, which has not yet been attempted to be proved.

If muscular Motion depends on the Influx of the nervous Liquid, the instantaneous Contraction of a Muscle, when the Mind wills to make it act, will easily be understood from the Nerves being always full of their Liquor.

If either the Nerves of any Muscle do not furnish a sufficient Quantity of their Liquor, or if the Fibres of a Muscle become too easily distractile, such a Muscle will be inactive, or paralytic.

If too great a Quantity of the Liquor of the Nerves is determined to a Muscle or Muscles, by
any

any Cause which the Mind cannot command, such Muscle or Muscles will be convulsed.

If the Motion of the Liquid of the Nerves is not uniform, but by Disease becomes irregular, an alternate Relaxation and Contraction of Muscles may be the Consequence; hence trembling Palsies, Chorea Sancti Viti, &c.

Tho' the Nerves may not furnish as much Liquor as may be sufficient to make Muscles contract with Strength enough to overcome the Resistances to their Action; yet there may be enough Liquor in the Nerves to allow the Impressions of Objects to be conveyed to the Sensorium; this may be one Cause of a Member's being sometimes sensible after it cannot be moved.

Unless the Liquor of the Nerves acquires some Energy in the Brain, which we have no Reason to think the Circulation of the Fluids in the Vessels can give it, or unless it has other Properties than what we can discover in it, or unless there is an Agent determining its Momentum towards some particular Parts, which we are not conscious of; if some of these do not obtain, the Action of the Heart continuing of equal Force to propel our Liquors, notwithstanding all the Resistances that are to it, is not to be explained.

All Muscles, but especially the Heart, continue to contract in an irregular Way, after they are cut away from the Animal to whom they belonged, which may be owing to the Liquors continuing to flow in the small Vessels, and being poured irregularly into the muscular Fibrillæ.

After the Heart, or any other Muscle, cut away from an Animal, has ceased to contract, its Contraction may again be restored by breathing upon it, or pricking it with any sharp Instrument. That Heat or Pricking should, by their Stimulus, occasion Contraction in a living Creature, may be

understood; but how they should have the same Effect in a Muscle separated from an Animal, I know not.

The Contents of several of the preceding Paragraphs are as inexplicable upon any other Supposition yet made concerning muscular Motion.

I know no Experiment or Observations by which any Thing can be proved, or from which any Thing can be reasonably inferred concerning the Uses of the Ganglions of the Nerves; and therefore pretend to give no Account of them.
MONRO.

WINSLOW considers the Ganglions of each intercostal Nerve as so many Origins of these Nerves, and, consequently, so many Cerebelli.

I shall close this Lecture with the following Lines:

*Nam quis non videt, finitæ si breve Corpus
Subjicitur Menti, Mens quanta sit illa supremo
Quæ regit Arbitrio vastum quem condidit Orbem?
Non poterit sine Consilio tam parva moveri
Machina, tam fragilis; te judice, tanta regetur
Mentis inops! Credant Epicuri de Grege Porci.*

POLIGNAC. ANTI-LUCRET. Lib. V.





LECTURE XXIII.

NEUROGRAPHY.



AS all the NERVES of the human Body arise originally from the Cerebrum or Cerebellum, by means of the Medulla Oblongata, or Medulla Spinalis; they egress in Fasciculi, regularly disposed in Pairs, like so many distinct Trunks, which are afterwards divided into Branches, Rami, Ramifications, and Filaments.

The Nerves of the Medulla Oblongata egress, for the most part, thro' the Basis of the Cranium, at Foramina situated according to their Disposition. Those of the Medulla Spinalis pass thro' the lateral Foramina of all the Vertebrae, and thro' the great anterior Foramina of the Os Sacrum.

We commonly reckon ten Pairs of these Fasciculi, or nervous Trunks, to the Medulla Oblongata; nine of which egress separately thro' particular Foramina of the Basis Cranii, and the tenth, which arises from the Extremity of that Medulla, passes thro' the great occipital Foramen.

The Trunks from the spinal Marrow are twenty-four Pairs, and may, in general, be termed Nervi VERTEBRALES, or INTER-VERTEBRALES. Seven of them are called CERVICAL NERVES; twelve, DORSAL, or COSTAL, being true INTER-COSTAL NERVES; and five, LUMBAR: To which must be

be added, five or six Pairs that pass thro' the Os Sacrum.

The first Pair of Nerves of the Medulla Oblongata are Nervi Olfactorii, formerly named Processus Mammillares, arise by medullary Fibres, anteriorly and exteriorly, from the Eminences of the Cerebrum, called Corpora Striata, between the anterior and middle Lobes.

They run anteriorly, towards the Os Ethmoides, on each Side the Crista Galli, in Form of medullary Cords, having a very slender Consistence; and, in this Course, they receive some medullary Fibres from the anterior Lobes of the Cerebrum.

They are at first very thin, but as they advance they become gradually larger and softer; and, having reached the Sides of the Crista without any Communication betwixt them, they send off a great Number of Filaments, which run thro' the Foramina of the Lamina Cribrosa*.

In their Passage thro' these Foramina, they are accompanied and invested by the same Number of small Productions from the two Laminæ of the Dura Mater, as particular Vaginæ; and are afterwards distributed, by an Infinity of small Filaments, to the Membrane which lines all the internal Parts of the Nose.

Each olfactory Nerve communicates, by particular Filaments, with some Branches of the Nervi Ophthalmici and Maxillaris Superior.

Nervi

* The tender Structure and sudden Expansion of these Nerves on such a large Surface, render it impossible to trace them far; which has made some Authors deny them to be Nerves: But when we break the Circumference of the cribriform Lamella, and then gently raise it, we may see the Distribution of the Nerves some way on the Membrane of the Nose.

The Contrivance of defending these long soft Nerves from being so much pressed by the anterior Lobes of the Brain, under which they

NERVI OPTICI arise from the Eminences of the Cerebrum, called THALAMI NERVORUM OPTICORUM; and being first of all incurvated externally, they afterwards approach each other, as they run over the Sella Sphenoïdalis of the Basis Cranii, at which Place they unite * a little, and afterwards separate again, in their Passage to the Foramina Optica, to the Orbits, and Globe of the Eyes †.

NERVI

they lie, is singular; because they have not only the prominent orbitary Processes of the frontal Bone to support the Brain on each Side, with the Veins going into the longitudinal Sinus, and other Attachments bearing it up; but there is a Sinus formed in each Lobe of the Brain itself for them to lodge in. Their splitting into so many small Branches before they enter the Bones of the Skull, is likewise peculiar to them: For, generally, the Nerves come from the Brain in disgregated Filaments, and unite into Cords as they are going out at the Foramina of the Bones. This Contrivance is the best for answering the Purpose they are designed for, of being the Organ of Smelling: For had they been expanded upon the Membrane of the Nose into a medullary Web, such as the optic Nerve forms, it would have been too sensible to bear the Impressions of such Objects as are applied to the Nose, and a Distribution in the more common Way of a Cord sending off Branches, would not have been equal enough for such an Organ of Sensation. MONRO's Anatomy of the Nerves.

* This Union of the optic Nerves is on the anterior Part of the Glandula Pituitaria, and is of a very singular Kind, as we have seen in the particular Description of the Head.

† Tho' the Substance of this Pair of Nerves seems to be blended at the Place where they are joined; yet Observations of People whose optic Nerves were not joined at all, and of others who were blind of one Eye from a Fault in the optic Nerve, or in those who had one of their Eyes taken out, make it appear that there is no such intimate Union of Substance; the optic Nerve of the affected Side only being wasted, while the other was large and plump: And the same Observations are contradictory to the Doctrine of a Decussation of all the Nerves; for the Disease could be traced from the affected Eye to the Origin of the Nerve on the same Side. In many Fishes, indeed, the Doctrine of Decussation is favoured; for their optic Nerves plainly cross each other without any Union at the Part where they are joined in Men, and most Quadrupedes.

Those People whose optic Nerves were not joined, having neither seen Objects double, nor turned their Eyes different Ways, is also a plain Proof that the Conjunction of the optic Nerves will not serve to account for either the uniform Motion of our Eyes, or our seeing Objects single with two Eyes.

NERVI MOTORES OCULORUM COMMUNES arise immediately before the Border of the anterior Margin of the great transverse Protuberance ordinarily called the *Processus Annularis* of the *Medulla Oblongata*.

Each Nerve perforates the *Dura Mater* behind the lateral Parts of the posterior Apophysis of the *Sella Sphenoidalis*, and afterwards runs along the superior Part of the *Sinus Cavernosus* of the *Dura Mater*, on one Side the Curvature of the carotid Artery, to the superior Orbitary, or sphenoid Fissure.

Thence it passes into the Orbit, and divides into four Rami, one superior, one internal, and two inferior, one of which is long, the other short.

The superior Ramus goes off as soon as the Trunk enters the sphenoid Fissure, and runs directly to the inferior Side of the *Musculus Rectus Superior* of the Globe of the Eye.

Having reached the Middle of that Muscle, or thereabouts, it sends up a Ramus to the *Levator Palpebræ Superioris*; and when this Ramus goes

The Retina of a recent Eye, without any Preparation, appears a very fine Web, with some Blood-vessels coming from its Center to be distributed on it; but after a good Injection of the Arteries that run in the Substance of this Nerve as is common to other Nerves, it is with Difficulty that we can observe its nervous medullary Substance. The Situation of these Vessels in the central Part of the optic Nerve, and the Want of medullary Fibres here, where the optic Nerve enters the Globe of the Eye, may be one Reason why we do not see such Bodies, or Parts of Bodies, whose Picture falls on this central Part of the Retina. An Inflammation in those Arteries of the Retina which an *Ophthalmia* is generally attended with, may very well account for that Tenderness in the Eyes, and Inability to bear the Light, which People have in that Disease. The Over-distension of these Vessels may likewise serve to account for the black Spots observed on bright-coloured Bodies especially, and for that smoky Fog, thro' which all Objects are seen by People in some Fevers. If those Vessels lose their Tone, and remain preternaturally distended, no Objects affect our Retina, tho' the Eye externally appears sound, or this may be one Cause of an *Amaurosis* or *Gutta Serena*. MONRO's Anatomy.

off nearer the sphenoid Fissure, it may be looked upon as the second superior principal Ramus of the Motor Oculi.

The other three Rami go off at some Distance from the superior Branch. The internal Ramus is distributed to the Musculus Rectus Internus of the Eye; the short inferior Ramus to the Rectus Inferior; and the long inferior Ramus to the Obliquus Inferior, into the Substance of which it penetrates, after having run along the Rectus Inferior.

Besides these four or five Rami, there is a small short Branch, which commonly arises from that which goes to the Musculus Obliquus Inferior, and forms a small lenticular Ganglion that detaches several very fine Filaments round the optic Nerve.

The Filaments of the Ganglion perforate the Tunica Sclerotica of the Eye, and then run between this Tunic and the Choroïdes all the way to the Iris, where they are distributed by very fine Ramifications.

The small lenticular Ganglion likewise produces other nervous Filaments, which communicate with the Ramus Internus, or Nasalis, of the orbitary Nerve*.

NERVI TROCHLEARES are long and small, arising behind the Eminences called Nates, from the lateral Part of the medullary Expansion which

* I have frequently observed, in Convulsions, the Eye-lids widely opened, the Cornea turned upwards and outwards, and the Eye-balls sunk into the Orbit; which well described the conjunct Action of the Muscles which this Pair of Nerves serves. The Distension of a considerable Branch of the Carotid, which passes over this Nerve near its Origin on each Side, may possibly be the Reason of that Heaviness in the Eye-lids and Eyes, after drinking hard, or eating much. MONRO.

lies above the Passage betwixt the third and fourth Ventricles of the Brain.

Thence they go, on each Side, to the Margin of the Fold formed by the Dura Mater, on the Extremity of the Apophysis Petrosa, behind the Sella Sphenoïdalis, that is, by the anterior Portions of the Septum Transversum.

There each Nerve perforates the Margin of the Fold, above the Passage of the Nerve of the third Pair, and more backwards and outwards: Afterwards it runs, in the Duplicature of that Fold, on one Side of the Nerve of the third Pair, along the superior Part of the Sinus Cavernosus, and passes into the Orbit thro' the sphenoïd Fissure, and into the Musculus Trochlearis.

Its Course is oblique over the other Nerves and adjacent Muscles, and it sends off small Filaments on each Side, appearing to communicate with the first Branch of the fifth Pair, or Nervus Ophthalmicus*.

NERVI TRIGEMINI are very large, and arise anteriorly from the lateral Parts of the transverse Protuberance of the Medulla Oblongata by a great Number of Filaments closely united together, which afterwards form two large flat Trunks, one on each Side. Each Trunk runs towards the Apex of the adjacent Os Petrosum, where it perforates the Dura Mater a little below the Margin of the Extremity or anterior Portion of the Septum Transversum of the Brain.

Having detached some Filaments to the Apex of the Apophysis Petrosa, or to a kind of sesamoïd

* The rotatory Motions, and the Advancement of the Globe of the Eye forwards, by which Motions several of our Passions are expressed, chiefly depending on these Muscles, the Nerves that serve them have been named PATHETICI.

Bone, which is often found near this Apex, it enters the Sinus Cavernosus; and, having sent some other Filaments to the Dura Mater, expands in the Sinus, and forms a kind of Plexus, or flat irregular Ganglion.

Afterwards the Trunk is divided into three large Rami more or less flatted, which run thro' the cavernous Sinus, being closely connected to the spongy Filaments thereof, and bathed in the venal Blood, which it contains. These three Rami are disposed laterally on one vertical Plane, and separate after the Manner of a Goose's Foot.

The first Ramus, commonly called *NERVUS OPHTHALMICUS WILLISII*, is the smallest and longest of the three, and enters the Orbit thro' the sphenoid Fissure; for which Reason *WINSLOW* names it *NERVUS ORBITARIUS*.

The second or middle Ramus, called also *NERVUS MAXILLARIS SUPERIOR*, passes thro' the superior maxillary Foramen of the *Os Sphenoides*.

The third or inferior Ramus, called also *NERVUS MAXILLARIS INFERIOR*, descends thro' the Foramen Ovale or Maxillare Inferius of the sphenoid Bone: The two maxillary Nerves are united at their Origin, for which Reason some Anatomists have divided the large Trunk into two principal Rami; and the second of these Rami into two others.

NERVUS ORBITARIUS, commonly called *OPHTHALMICUS*, which is the first Ramus of the fifth Pair, as soon as it enters the Orbit, thro' the sphenoid Fissure, is divided into three Rami; one superior, or frontal; one internal, or nasal; and one external, or lacrymal: And before its Entry it sometimes gives and sometimes receives communicating Rami. It communicates, by a Filament or two, with the Nerve of the sixth Part, and that commonly called Inter-costalis.

The Ramus Superior, or Frontalis, which might likewise be named NERVUS SUPERCILIARIS, is the most considerable of the three, and runs along the superior Part of the Orbit close to the Membrane which lines it, sending Filaments to the Fat which surrounds the Globe of the Eye, to the adjacent Membranes and Musculus Levator Palpebræ.

Afterwards it passes thro' the Foramen Superciliare, and, being divided towards each Side, is spent on the circumjacent Portions of the Musculus Frontalis, Orbicularis, and Integuments; communicating with an adjacent Ramus of the Portio Dura of the auditory Nerve.

The Ramus Internus or Nasalis of the orbitary Nerve, runs towards the Nose, and near its Origin sends off a Filament which communicates with the small lenticular Ganglion already mentioned.

This Filament sometimes comes from the Trunk of the orbitary Nerve before the Division, and adheres to the internal Ramus all the way to where the Motor Communis is divided.

This nasal Ramus first runs obliquely over the optic Nerve, and under the two Musculi Levatores, giving off some Filaments to the nearest Parts of these Muscles; afterwards it runs between the Musculus Rectus Internus and Obliquus Major, along the internal Side of the Orbit; and in its Passage sends a small Filament thro' the internal orbitary Foramen.

Thence it passes over the Musculus Rectus Internus to the great or internal Angle of the Eye, where it is distributed to the adjacent Parts, that is, to the Caruncula and Sacculus Lacrymalis, the nearest Portions of the Musculus Orbicularis, Superciliaris, Pyramidalis Nasi, and to the Integuments.

The

The small lateral Filament which it sends thro' the orbitary Foramen, returns into the Cranium, ascending from before backwards on one Side of the Os Cribrosum, and, having reached the anterior Part of the Duplication of the Dura Mater, it joins the Filaments of the olfactory Nerve on the Lamina Cribrosa, together with which it passes thro' the anterior Foramina of that Lamina, and is distributed to the Nose.

The Ramus Externus, or Lacrymalis, goes chiefly to the Glandula Lacrymalis, upon which it is distributed, and from whence it has its Name. It seems sometimes to be a Branch from the Ramus Frontalis, and often arises from the orbitary Nerve more posteriorly than the other Rami. It adheres closely to the Dura Mater, and runs obliquely along the internal Side of the Orbit, on the Musculus Rectus Externus, to the Glandula Lacrymalis.

Before it reaches the Gland it sends a small Ramus to the external lateral Part of the Orbit, which is sometimes lost in the Diploë of the Cranium, and sometimes perforates the adjacent Part either of the Os Frontis, or Malæ, &c. sending Filaments to the nearest Portions of the Musculus Temporalis, Orbicularis Palpebrarum, Masseter, &c. and of the Integuments; and it likewise gives Filaments to the Fat and Membrana Conjunctiva of the Eye*.

NERVUS

* This may be the Cause of a Sympathy between the optic Nerve and Uvea, by which we more readily acquire the Habit of contracting the Iris, and thereby lessen the Pupil, when too strong Light is excluded; and, on the contrary, enlarge the Pupil, when the Light is too faint. This, with the Sympathy that must arise from some of the Nerves of the Membrane of the Nostrils, being derived from the first Branch of the fifth Pair of Nerves, may also be the Cause why an Irritation of too strong a Light falling upon the Retina may produce Sneezing; as if a Stimulus had been applied to the Membrane

NERVUS MAXILLARIS SUPERIOR is the second Ramus of the fifth Pair, egresses from the Cranium between the Foramen Ovale and Fissure of the Os Sphenoides, passing thro' the Foramen Rotundum or Maxillare Superius of the same Bone.

Immediately after its Passage it sends a Filament to the external Side of the Orbit, which, having perforated the Os Malæ, is distributed to the Parts which cover that Bone, communicates with a circumjacent Branch of the Portio Dura of the auditory Nerve, and sends small Filaments to the Fat in the inferior Part of the Orbit.

Soon afterwards it is divided into three Rami, the first of which is called Sub-orbitarius, the second Palatinus, and the third Spheno-Palatinus, which last is sometimes only a Ramus of the first; but still the common Division may be retained.

The sub-orbitary Ramus is the most considerable of the three: It runs in the Canal of the inferior Portion of the Orbit, and egresses by the exterior orbitary Foramen, which is sometimes double.

In this Passage it sends inferiorly, thro' the Foramina of the Canal, small Filaments which enter the Sinus Maxillaris, and are distributed to the Membrana Pituitaria in that Sinus, to the Substance of the Bone, the Alveoli, anterior Dentes Molares, and to the Dentes Canini and Incisores.

of the Nose itself. In the Megrim all the Rami of this Nerve discover themselves to be affected; for the Forehead is racked with Pain, the Globe of the Eye is pained, and feels as if it was squeezed, the Eye-lids shut convulsively, the Tears trickle down, and an uneasy Heat is felt in the Nose. Hence we can understand where external Medicines will have the best Effect, when applied to remove this Disease; to wit, to the Membrane of the Nose and the Forehead; and why alternate Pressure near the superciliary Foramen of the frontal Bone sometimes gives immediate Relief in the Megrim. MONRO.

As it enters the Canal it sometimes gives off a Filament to the posterior Molares; and, among all these Filaments, there is one, at least, which runs along the superior Side of the Curvature of the Palate, to the Union of the *Ossa Maxillaria*.

This Ramus, having passed out of the osseous Canal thro' the *Foramen Sub-Orbitarium Anteriorius*, is distributed to the *Musculus Orbicularis Palpebrarum*, the adjacent Muscles of the Nose and Lips, and to the Integuments; communicating with a Ramus of the *Portio Dura* of the auditory Nerve.

The *Ramus Palatinus* of the superior maxillary Nerve descends before the pterygoid Apophyses of the *Os Sphenoides*, in the Canal formed by the *Ossa Maxillare* and *Palati*; and, having passed out of that Canal thro' the *Foramen Palatinum Posterius*, is distributed, by several Filaments, to the glandular Tunic of the Palate, *Septum Palati*, and the Muscles belonging to that Part. Some of these Filaments go as far as the *Foramen Palatinum Anteriorius*, or *Incisforium*.

As it descends in the Canal, it is, at first, a little bent, and then sends Filaments to the *Musculus Pterygoidæus Externus*, *Peri-Staphylini*, and the Curvature of the Pharynx; it likewise sends other Filaments thro' the small Foramina in the posterior Part or Tubercle of the *Os Maxillare*, and to the *Sinus Maxillaris* and posterior *Dentes Molares*.

The *Ramus Spheno-Palatinus* passes thro' the osseous Foramen of the same Name, and is distributed to the *Musculus Pterygoidæus Internus*, the posterior Parts of the Nares, adjacent *Sinus Sphenoidalis*, and to the *Tuba Eustachiana*.

It likewise sends a Filament thro' the *Foramen Pterygoïdes*, which perforates the *Radix* of the Apo-

Apophysis Pterygoïdes from behind forwards, and joins the Nervus Maxillaris Inferior*.

NERVUS MAXILLARIS INFERIOR, the third Ramus of the fifth Pair, is larger at its Origin than the other two: It goes out of the Cranium by the Foramen Ovale of the sphenoid Bone, and runs between the two Musculi Pterygoïdæi, below the great Sinus of the inferior Maxilla, where it enters the osseous Canal of that Maxilla.

As soon as it leaves the Cranium, it sends off four principal Rami, and, before it enters the Canal of the inferior Maxilla, it gives off another Ramus to the Tongue: The four first Rami arise very near each other, so that the Size of this Nerve decreases very much between the Musculi Pterygoïdæi.

The first Ramus of this Trunk ascends to the temporal Muscle, on the internal Side of which it is distributed, and also between its Fibres.

The second Ramus runs behind the Condyle of the inferior Maxilla, where it divides into two Filaments, which run from within outwards, and communicate with the adjacent Ramus of the Portio Dura of the auditory Nerve behind the external Side of the Condyle.

At the Origin of these two Filaments it sends off a small Ramus, which ascends before the external Ear towards the Temples, giving Filaments to the Concha of the Ear in its Passage.

The Ramus of this Trunk passes between the two Apophyses of the inferior Maxilla, perforates

* Hence an Obstruction in the Duct of the maxillary Sinus, that obliges the Liquor secreted there to find out a preternatural Route for itself, as I have seen more than once, may be occasioned by the Pain of the Teeth. MONRO.

the inferior Part of the temporal Muscle, and gives it several Filaments.

Afterwards it bends inferiorly upon the Musculus Masseter, to which it is chiefly distributed, giving Filaments to the adjacent Integuments, and communicating with the Portio Dura of the auditory Nerve on the Side of the Os Malæ: It terminates by Filaments which go to the Musculus Buccinator, Muscles of the inferior Lip, and the Integuments of these Parts.

The fourth Ramus of the Trunk of the inferior maxillary Nerve is oftentimes no more than a Ramus of the third Branch, which goes off near its Origin: It passes over the Musculus Pterygoïdæus Externus, to which it gives Filaments, and is distributed to the Pterygoïdæus Internus, and to the nearest Portion of the Temporalis.

It is likewise distributed to the Musculus Buccinator, Glands of the Mouth, and Muscles of the Lips: Sometimes it sends off a Filament, that ascends upon the Concha of the external Ear.

Besides these four Rami, several small Filaments go off on each Side, one of which runs to the Foramen Pterygoïdæum, where it joins a Filament of the Nervus Maxillaris Superior, and then continues its Course to the Membrane which covers the Vomer and adjacent Parts of the internal Nares.

The Ramus that goes to the Tongue, which may be named NERVUS LINGUALIS, or HYPOGLOSSUS MINOR, to distinguish it from the HYPOGLOSSUS MAJOR, which belongs to the ninth Pair, is detached from the Maxillaris Inferior as it passes between the Musculi Pterygoïdæi, and sometimes a little before.

It is a very considerable Ramus, and sometimes nearly as large as the Trunk which it accompanies between the two Muscles already mentioned, and, leaving

leaving it a little above the Canal of the inferior Maxilla, it runs over the Pterygoïdæus Internus, and gives it some Filaments.

This Ramus Lingualis, a little after its Origin, communicates with the Trunk by a short collateral Ramus which is sometimes plexiform: At this Place it sustains a particular Filament, which, according to the common Opinion, arises from it, and goes to the internal Ear.

This particular Filament of the Nervus Lingualis is supposed, by Anatomists, to be a Recurrent which ascends posteriorly thro' the Tympanum, and joins the Portio Dura of the auditory Nerve: But as the Angle, which it makes with the small Nervus Lingualis, is very acute, and turned forwards; there is more Reason to think that it comes from the internal Ear to that Nerve.

Afterwards this lingual Ramus passes under the lateral Part of the Tongue, and over the Glandula Sub-lingualis, giving Filaments to the adjacent Portions of the Muscles of the Tongue and those of the Os Hyoïdes and Pharynx.

Having communicated, by several Filaments, with the Extremities of the Nerve of the ninth Pair, or Lingualis Major, it enters the Substance of the Tongue, and terminates near its Apex.

Lastly, The inferior maxillary Nerve, before it enters the Canal of the inferior Maxilla, sends Filaments to the adjacent Portions of the Musculus Pterygoïdæus Internus, Digastricus, &c. it likewise detaches a Filament or two along the Periosteum, to be distributed to the Musculus Mylo-Hyoïdæus and Glandula Sub-lingualis. The Marks of these Filaments often appear upon the Bone, all the way from their Origin, and sometimes they pass thro' a small entire osseous Canal, lying

lying on the Surface of the internal Side of the Bone.

After the inferior maxillary Nerve enters the Canal of the inferior Maxilla, it runs under the Alveoli, and distributes Filaments to each Tooth, all the way to the Foramen near the Chin, where it sends another Ramus forwards into the Diploë, which is distributed to the other Teeth, that lie between that Foramen and the Symphysis of the Chin*.

NERVI MOTORES EXTERNI, the sixth Pair of Nerves from the Head, are smaller, but yet a little larger than those of the fourth Pair: They arise, from the Union of the Medulla Oblongata, between the great transverse Protuberance and the Corpora Olivaria, whence they advance to the Dura Mater, and enter it on the Extremity of the Production of the Os Occipitis anteriorly, and a little on one Side of the Symphysis of that Bone with the Os Sphenoïdes.

Each of these Nerves runs afterwards in the cavernous Duplication of the Dura Mater, on one Side of the Bottom of the Sella Sphenoïdalis and of the carotid Artery, to which it adheres very closely; and it there communicates with a Ramus of the fifth Pair by one or two short Filaments.

* Hence a convulsive Contraction of the Muscles of the inferior Maxilla, or the Mouth's being involuntarily shut, a great Flow of Spit-
tle or Salivation, a Pain in the Ear, especially in Deglutition, and a
Swelling all about the Throat, are natural Consequences of a violent
Irritation of the Nerves of the lower Teeth in the Tooth-ach; and
Pain in the Teeth and Ear is as natural a Consequence of an Angina.
Hence alternate Pressure on the Chin may sometimes relieve the Vi-
olence of the Tooth-ach. Hence destroying the Nerves of a Tooth by
actual or potential Cauterics, or pulling a carious Tooth, so often
removes immediately all these Symptoms. Hence no Cure is to be
found for some Ulcers in the superior or inferior Maxilla, but by
drawing a Tooth. Perhaps the Sympathy of the Organs of Tasting
and Smelling may, in some measure, depend on their both receiving
Nerves from the fifth Pair. MONRO.

Immediately after, and behind this Communication, the Motor Externus sends down a Filament, which at first appears to run from before backwards, like a Recurrent, and immediately enters the large osseous Canal of the Apophysis Pectorea, on one Side of the internal carotid Artery.

This nervous Filament, which is sometimes double, is commonly taken for the Radix or Origin of the celebrated intercostal Nerve, which WINSLOW terms SYMPATHETICUS MAJOR; but as it makes an acute Angle, in an opposite Direction, with the Nerve of the sixth Pair, it seems rather to ascend with the carotid Artery, and to join that Nerve, than to arise from it.

The Nerve of the sixth Pair, which is sometimes double, or split in two Parts, before it enters the Dura Mater, passes afterwards, through the sphenoid or superior orbital Fissure, to the Musculus Rectus Externus of the Globe of the Eye*.

NERVI

* According to the common Opinion, this Beginning of the INTERCOSTAL NERVE, as it is called, would rise in a Manner not so ordinary in Nerves. In the next Place it is observed, that the sixth Pair is larger nearer to the Orbit, than it is before it comes to the Place where this Nerve is said to go off; and therefore it is more probable that it receives an Addition there, rather than gives off a Branch.

It is found, that, upon cutting the intercostal Nerves of living Animals, the Eyes plainly were affected, they lost their bright Water, the Gum, or Gore, as we call it, was separated in greater Quantity, the Pupil was more contracted, the cartilaginous Membrane at the internal Canthus came more over the Eye, and the Globe of the Eye itself was diminished.

To this it is answered, in Defence of the more common Doctrine,
1. That other Branches of Nerves go off in a reflected Way as well as this does, supposing it to be the Beginning of the Intercostal, and that the Reflexion would rather be greater, if it is thought to come up from the Intercostal to the sixth.

2. It is denied that this Nerve is generally thicker at its anterior than its posterior Part; and if it was supposed to be thickest nearest to the Orbit, the Conclusion made above could not be drawn from
this

NERVI AUDITORII arise from the lateral and posterior Part of the great transverse Protuberance of the Medulla Oblongata: Each of these Nerves is double, or consist of two Cords, which accompany each other very closely to the Foramen Auditorium Internum of the Apophysis Petrosa.

One of these Cords is small, solid, and anterior, being called the PORTIO DURA; the other less solid, and posterior, called PORTIO MOLLIS.

The PORTIO MOLLIS terminates in the great Fossula of the Foramen Auditorium Internum, and is distributed to the Organ of Hearing thro' several other small Foramina: This Portion alone deserves the Name of the AUDITORY NERVE; but the particular Description thereof must be referred to that of the Ear.

The PORTIO DURA passes, thro' the small Fossula of the internal auditory Foramen, into the winding Duct of the Apophysis Petrosa, and egresses, by the Foramen Stylo-Mastoïdæum, to the Face and other adjacent Parts. As it passes thro' the winding Fallopiian Duct; it touches the Dura Mater at the small Aperture on the superior Side of the Apophysis Petrosa, where it joins some Filaments from the fifth Pair.

this Appearance, because other Nerves enlarge sometimes where there is no Addition made to them. as in the Instance already mentioned of the Trunk of the fifth Pair while below the Dura Mater.

3. The Experiments on living Animals indeed shew, that the Eyes are affected upon cutting the intercostal Nerve, but not in the Way that might have been expected, if the Intercostal had furnished such a Share of the Nerve that goes to the abductor Muscle of the Eye: For it might have been thought, that this Muscle would have been so much weakened immediately upon cutting the Intercostal, as its Antagonist, the Adductor, would have greatly prevailed over it, and have turned the Eye strongly in towards the Nose, which is not said to be a Consequence of this Experiment. So that the Arguments are still equivocal, and more Observations and Experiments must be made before it can be determined, with Certainty, whether the sixth Pair gives or receives a Branch here. MONRO.

It

It likewise gives off a Filament to the Muscle of the Stapes; and, as it egresses, it gives or receives another Filament which passes by the Tympanum, and joins the Ramus Lingualis of the inferior maxillary Nerve, as we shall see more particularly in the Lecture on the EAR.

WINSLOW calls this Portion of the auditory Nerve, *NERVUS SYMPATHETICUS MINOR*.

The Trunk of each Nerve of the *PORTIO DURA*, or of the *SYMPATHETICI MINORES*, having passed thro' the *Ductus Petrosus Fallopii*, and communicated with the *Dura Mater*, &c. sends off, at about the sixth Part of an Inch from where it egresses at the *Stylo-Mastoïd Foramen*, two Rami, one superior, the other inferior.

The superior Ramus ascends chiefly to the posterior Parts of the external Ear, to which it is distributed, communicating, as it passes behind the Ear, with a Ramus of the second Pair of the cervical Nerves; and anteriorly with a Ramus of the *Maxillaris Inferior*.

The inferior Ramus is spent on the three Musculi *Styloïdæi*, *Digastricus*, and the superior Extremity of the *Sterno-Mastoïdæus*, reaching, in some Subjects, as far as the Middle of that Muscle. In Place of these two single Rami, small Ramifications sometimes egress from the Trunk.

Afterwards the Trunk of the *Portio Dura* advances forwards thro' the parotid Gland, to which it gives several Filaments, some of these Filaments running from without internally, and surrounding that Ramus of the external carotid Artery which runs behind the Ear*. Sometimes,
tho'

* Hence, in the Tooth-ach, the Pain is sometimes very little in the affected Tooth, compared to what it is all along the Side of the Head, and in the Ear. Hence, probably, the Relief of the Tooth-ach

tho' very seldom, the Trunk itself is split, to give Passage to the Artery.

This Trunk, having passed thro' the parotid Gland, behind the Angle of the inferior Maxilla, is divided into two large Rami, one superior, the other inferior.

The superior Ramus of the Portio Dura is the most considerable of the two; and, having ascended for about the third Part of an Inch, it divides into seven or eight Rami.

These Rami are spread superficially, and in an irregular radiated Manner, on all the lateral Parts of the Face, from the Hair as low as the inferior Lip, between the Ear and Nose, distributing a prodigious Number of cutaneous Nerves.

In some Subjects these Rami, at their first Separation, form a kind of Plexus which resembles a Goose's Foot.

The first, second, and third Rami are distributed to the anterior Part of the Ear, on the lateral Parts of the Head, the temporal and frontal Muscles, and Parts adjacent.

One of these Rami, and sometimes the great superior Branch, detaches inwards behind the Condyle of the inferior Maxilla, and before the temporal Vein, two or three Filaments which communicate with the inferior maxillary Nerve.

The fourth Ramus goes to the Foramen Superciliare, or Supra-Orbitarium, giving, in its Passage, several Filaments to the external, lateral, and superior Parts of the Musculus Orbicularis Palpe-

ach by Blisters applied behind the Ear, or by a hot Iron touching the Anti-helix of the Ear. By this Communication or Connexion possibly too it is, that a vibrating String, held between one's Teeth, gives a strong Idea of Sound to the Person who holds it, which no Body else can perceive. Perhaps, too, the Distribution of this Nerve occasions the Head to be so quickly turned upon the Impression of Sound on our Ears.

brarum; and afterwards communicating with the orbitary Nerve which egresses by the same Foramen.

The fifth Ramus is distributed, by small Filaments, on the lateral Part of the Cheek, and is partly lost in some small Foramina at the Basis or Root of the Zygoma; giving, likewise, some Filaments to the external inferior Part of the Musculus Orbicularis Palpebrarum.

The sixth and seventh Rami, and likewise the eighth, when it is found, are spread on the whole Cheek as far as the Nose.

One of these latter Rami passes under or behind the Musculus Zygomaticus, to which it gives Filaments; and then, perforating and giving Filaments to the middle inferior Part of the Musculus Orbicularis Palpebrarum, it goes to the inferior orbitary Foramen in the Os Maxillare, and communicates with the Nervus Maxillaris Superior.

The last Ramus communicates, by some Filaments, with an adjacent Ramus of the great inferior Branch of the Portio Dura.

This large inferior Branch, which is somewhat less than the superior, runs under the Angle of the inferior Maxilla, and is distributed, by several Rami, to all the inferior lateral Parts of the Face, and to the circumjacent Parts of the Throat, where it chiefly terminates by a vast Number of cutaneous Filaments.

The superior Rami of the great inferior Ramus ascends, on the Musculus Masseter, to the inferior Part of the Zygomaticus, Buccinator, and other Muscles of the Lips.

One of these superior Rami communicates with one of the inferior Rami of the superior Ramus, and, by the Intervention thereof, communicates likewise, in some measure, with the sub-orbitary
Ramus

Ramus of the Nervus Maxillaris Superior, or that which egresses by the Foramen Sub-Orbitarium.

The most considerable of all these Rami runs anteriorly along the Basis of the inferior Maxilla, sending Filaments to the Musculus Cutaneus, and to the Muscles of the inferior Lip, which it perforates near the Chin, and there communicates with the Nervus Maxillaris Inferior.

The inferior Rami run under the inferior Maxilla, giving Filaments to the Glandula Sub-Maxillaris, and are distributed to the Throat on the Musculus Cutaneus, intersecting the external jugular Vein. One or more of these Rami are observed to descend to the Middle of the Musculus Sterno-Mastoidæus, where it communicates with a Ramus of the second vertebral Pair.

NERVI SYMPATHETICI MEDII, called by the Antients PAR VAGUM, arise from the posterior Part of the Medulla Oblongata, from the great transverse Protuberance, and from the anterior Part of the Corpora Olivaria, by several separate Filaments which are afterwards collected in a Fasciculus, that runs towards the anterior Part of the Foramen Lacerum of the Basis Cranii, where it perforates the Dura Mater immediately before the Extremity of the great lateral Sinus.

The Passage of this Nerve is separated from that of the Sinus by a small membranous Septum of the Dura Mater, and by the little osseous Prominences of the Foramen Lacerum.

This great Fasciculus does not penetrate the Dura Mater thro' a single Aperture, and as one Cord; for several of the anterior Filaments form a particular Portion, divided from the main Body by a very thin membranous Septum.

The Filaments which compose the large Portion, when carefully examined, seem to perforate

the Dura Mater separately, by small Apertures or Pores, which lie very near each other.

Tho' these two Portions egress separately, they are looked upon as a common Trunk; and the small Portion is looked upon as a Branch of the great one, which lies behind the other, and is esteemed the true Trunk of this eighth Nerve.

As this Trunk egresses, it receives posteriorly a small nervous Cord, which ascends laterally from the spinal Canal; and, passing thro' the great occipital Foramen on the Dura Mater, joins this Trunk. This small Cord is named *NERVUS ACCESSORIUS OCTAVI PARIS*, or *NERVUS SPINALIS*.

As the two Portions pass thro' the Dura Mater and Foramen Lacerum, they are closely united, and communicate by Filaments which increase the Size of the small Portion. The large Portion likewise communicates with the *Nervus Accessorius*, to which it is strongly connected during this Passage.

The small or anterior Portion, having passed out of the Cranium, separates from the large one as a Branch from a Trunk; and thence it has been called the first Branch of the eighth Pair.

It is bent in Form of an Arch, and, passing interiorly on the Side of the digastric Muscle, it supplies the *Musculi Genio-Hyoïdæi*, those near the Basis of the Tongue, and those of the Pharynx.

About two Fingers Breadth from where it leaves the Cranium, this Portion sends posteriorly one Ramus, which is bent, in the same Direction, like an inverted Arch; and detaches, from its convex Side, at least three Filaments.

The first, which is sometimes double, communicates with the Trunk of this eighth Pair on one Side

Side of the Ganglion of the intercostal or great sympathetic Nerve : The second joins the Nervus Accessorius ; and the third goes to the Pharynx.

Afterwards this small Portion goes to the Tongue, where it communicates with the Extremities of the small Nervus Hypo-glossus, or Ramus Lingualis of the inferior maxillary Nerve, and with those of the Hypo-glossus Major, or Nerve of the ninth Pair.

The large Portion of the eighth Pair, or middle sympathetic Nerve, adhering by one Side to the first Ganglion of the Sympatheticus Maximus, and by the other to the Hypo-glossus Major, to both which it gives communicating Filaments ; sends off, a little below the small Portion, another small Ramus, that goes, by several Filaments, to the Pharynx.

A little below, or on one Side of the Union of the eighth Pair with the ninth, this Portion or Trunk forms a Ganglion, and gives off a third Ramus, which runs before the internal carotid Artery to the Larynx, Musculi Laryngis, Glandula Thyroides, and Muscles of the Os Hyoides.

This third Ramus passes between the Cornu of the Os Hyoides and the Ala of the Cartilago Thyroides, and, running in between that Cartilage and the Cartilago Cricoides, communicates with the Extremities of the Nervus Recurrens.

Afterwards the large Trunk descends on the anterior Side of the first Ganglion of the Nervus Sympatheticus Maximus, along the anterior vertebral cervical Muscles, by the Side of the carotid Artery, and behind the internal jugular Vein ; being accompanied by the intercostal Nerve as far as the last cervical Vertebra.

Thro' all this Course the Trunk is invested by a kind of cellular, filamentous, or membranous Vagina, common to it with the internal carotid

Artery, the internal jugular Vein, and the great sympathetic Nerve. In its Passage it gives small Rami to the adjacent Parts, to the Pharynx, Oesophagus, and to the carotid Artery and jugular Vein. One of these small Rami, in its Course downwards, joins a Ramulus of the second cervical Pair, and is distributed to the Glandula Thyroides.

The Trunk, having reached as low as the Larynx and Glandula Thyroides, sends out a Ramus, which, descending on the anterior Side of the internal carotid Artery, joins a Filament from the second Ganglion of the intercostal Nerve, with which it runs to the Plexus Pulmonaris.

Afterwards both Trunks of the Nerves of the eighth Pair enter the Thorax, before the Origin of the subclavian Arteries, which they cross, and run behind the Lungs, to the Oesophagus. At this Place there is some Difference in the Distribution of the two Trunks, which, in every other Respect, is pretty much the same.

As the right Trunk passes before the subclavian Artery, it sends off a considerable Ramus which bends posteriorly under the Artery, and ascends on one Side of the Aspera Arteria, to which, and the Oesophagus, it sends Filaments as high as the Larynx. This Ramus is called *NERVUS RECURRENTS*.

This *RECURRENT NERVE*, having reached the Larynx, sends Rami to the Muscles thereof, the Pharynx, and Glandula Thyroides; then it runs in behind the Cornua of the Cartilago Thyroides, where it joins the Extremity of the third Ramus of the Trunk of this eighth Pair, communicating with it.

The right Trunk, having given off the Recurrent of the same Side, descends on one Side of the Aspera Arteria, and behind the Origin of the
right

right Lung, where it adheres to the Oesophagus; and in this Course it sends out several Rami.

The superior Rami run on the anterior Side of the inferior Extremity of the Aspera Arteria and Bronchia, and are all united to Filaments of the great sympathetic Nerve, before the Bifurcation of the Trachea, and likewise to the Ramifications of the same Nerve from the other Side: The other Rami which the Trunk sends off, as it descends behind the Bronchia and Lungs, unite with Filaments of the great sympathetic Nerve.

The left Trunk of the eighth Pair is ramified in the Thorax, much in the same Manner with that of the right Side, with this Difference only, that the left recurrent Nerve egresses lower than the right; for it passes below the great Curvature of the Aorta, and behind the Ductus or Ligamentum Arteriosum, and afterwards ascends, on one Side of the Trachea Arteria, to the Larynx, much in the same Manner with the other.

This Difference in the going off of the two Recurrents, is the Reason why the left Trunk does not descend so strait as the right; and the left Recurrent gives off some of the Rami, which answer to those that come from the Trunk itself on the right Side.

Immediately after the Origin of the left Recurrent, the left Trunk sends down a Ramus which goes partly to the Plexus Pulmonaris; and partly to the Oesophagus and Aorta.

These reciprocal Ramifications of both Trunks of the eighth Pair, and their mutual Communications with the Filaments of the intercostal or great sympathetic Nerve, form particular Intertextures called Plexus; the most considerable of which are those called Plexus Cardiacus and Plexus Pulmonaris.

The PLEXUS CARDIACUS is formed above the Lung, on the anterior Side of the Bronchia, and produces a great Number of Filaments, some of which go to the Pericardium, and the rest go thro' it, round the great Vessels, to be distributed to the Heart.

The PLEXUS PULMONARIS is composed of the following Ramifications which the two Trunks send off, as they descend behind the Lungs: Some of the Filaments detached thence, ascend above the Bronchia at their Origin, but the greatest Part run below, being distributed along with them thro' the whole Lungs.

Besides these Plexus, the two Trunks give off Rami to the Parts near which they pass; such as the posterior Part of the Mediastinum, Oesophagus, and Aorta; and, by all these Ramifications, the Trunks are gradually diminished.

After having sent off the two Plexus, these Trunks change in a very remarkable Manner. The Trunk on the right Side runs insensibly posteriorly, as it descends, and to that on the left Side, anteriorly in the same Manner.

In their Passage they send several Filaments anteriorly and posteriorly to the Oesophagus, which unite, at different Distances, with the Filaments from the same Trunk, and with the like Filaments from the Trunk on the other Side; and the posterior Filaments from the left Trunk are, in some Subjects, more considerable than the anterior ones from the right.

These repeated Divisions and Re-unions, which represent a kind of Plexus, cause the original Trunks to degenerate, in some measure, into two particular Cords, one anterior, the other posterior, which are called NERVI STOMACHICI.

The posterior STOMACHIC NERVE arises principally from the right Trunk, and the anterior one
from

from the left; and, accordingly, the posterior Cord is oftentimes much stronger than the anterior, because of the Difference between the Filaments, of which each of them is composed.

These two stomachic Cords pass, along with the Extremity of the Oesophagus, thro' the Aperture in the small Muscle of the Diaphragm, and are distributed on the Stomach. The anterior Ramus is spread on the superior, or, as it is commonly called, the anterior Side; and the posterior on the inferior or posterior Side.

The Ramifications of both Rami communicate with each other, and form particular Inter-textures chiefly near the superior Orifice of the Stomach, and along the small Curvature, all the way to the Pylorus; by all which a kind of Plexus is formed called CORONARIUS STOMACHICUS.

This coronary Plexus, thus formed, sends off, near its Origin, two small Rami; one of which seems to come chiefly from the great anterior stomachic Ramus, the other from the posterior one: These two small Rami unite near the Trunk of the hepatic Artery, which having accompanied a little way, are divided into two very short Rami.

These two Rami run, presently afterwards, to the right and left Sides, immediately above the transverse Ramus that forms the Communication between the semi-lunar Ganglions of the two great sympathetic Nerves; and they terminate, by uniting with this Ramus, in a triangular Form.

In this Manner end the Nerves of the eighth Pair, or the Sympatheticus Medius of each Side, by contributing, together with the Sympatheticus Maximus, to the Formation of several Plexus in the Abdomen, which are ascribed principally to the last named Nerve. Among these are the Plexus Hepaticus, Splenicus, Mesenterici, and the Renales.

We see, likewise, that these two great Pairs of Nerves have a perpetual Correspondence thro' all the Viscera of the Abdomen; as well as in the Thorax*.

NERVI ACCESSORII OCTAVI PARIS arise, by several Filaments, from both Sides of the cervical Medulla Spinalis, sometimes higher, and sometimes lower. Each of them ascends between the two nervous Planes that egress from the spinal Marrow, to form the vertebral Nerves; and they gradually increase, in their Course upwards, by means of several Filaments which they receive from the posterior nervous Planes.

Having reached above the first Vertebra, each Nerve is fixed to the posterior Side of the Ganglion of the Nervus Sub-Occipitalis, or that of the tenth Pair; and having, at the superior Part of this Adhesion, received two Filaments from the posterior Portion of the Medulla, they separate from the Ganglion, and continue their Course superiorly. WINSLOW has sometimes found these two Filaments without any Communication with the Ganglion or the anterior Plane; so that they seem rather to belong to the Nervus Accessorius, than to the Sub-Occipitalis.

* From the Distribution of this PAR VAGUM we may learn how tickling the Fauces with a Feather, or any such Substance, excites a Nausea and Inclination to vomit. Why coughing occasions vomiting, or vomiting raises a Cough. Hence we see how the nervous Asthma and Tussis Convulsiva, Kinkcough, are attended with a streightening of the Glottis; why Food, difficult of digesting, occasions the Asthma to weakly People, and why Emetics have frequently cured the Asthma very speedily. Why an Attempt to vomit is sometimes in Danger of suffocating asthmatic People. Why the superior Orifice of the Stomach is so sensible as to be looked on as the Seat of the Soul by some. Why People subject to Distensions of the Stomach have so often the Sensations of Balls in their Breast or Throats. Why the Globus Hystericus is so often attended with a violent Strangulation at the Glottis. MONRO.

They enter the Cranium by the great occipital Foramen, and, having communicated with the Origin of the Sub-Occipitalis, or Nerves of the tenth Pair, and with the great Hypo-glossi or ninth Pair, they return out of the Cranium with the Nerves of the eighth Pair, or Sympathetici Medii, with which they communicate in their common Passage thro' the Cranium.

As soon as they get without the Cranium, each of them gives off a considerable Ramus, which divides into two. One is very short, and immediately joins the Trunk of the eighth Pair; the other, which is longer, joins the small Portion or first Ramus, which goes to the Tongue. They likewise communicate with the great Hypo-glossus and Sympatheticus on each Side.

Afterwards the Nervus Accessorius runs posteriorly, and, perforating the Musculus Sterno-Mastoidæus, runs to the Trapezius, on which it is distributed, and terminates, after having supplied the Rhomboïdes. In this Course it communicates with the first three Pairs of the cervical Nerves, and gives Rami to the cervical Glands, the Musculus Angularis of the Scapula, the Complexus, Occipitalis, and to the Integuments.

NERVI HYPO-GLOSSI EXTERNI, or MAJORES, as they are commonly called, or the PAR LINGUALE, arises on each Side, between the Corpora Pyramidalia and Olivaria, by several small Filaments, which, uniting together, form ordinarily two small Rami on each Side. These two Rami perforate the Dura Mater by two small separate Foramina, and afterwards soon unite in one Trunk on each Side, which egresses from the Cranium by the anterior condyloid Foramen of the Os Occipitis.

As soon as they leave the Cranium, each Trunk adheres very closely to the external Side of the
Trunk

Trunk of the eighth Pair, and that of the tenth; thence each Nerve passes on the anterior Side of the great Ganglion of the Sympatheticus Maximus, and runs between the internal jugular Vein and the adjacent carotid Artery, and then to the Tongue on one Side of the digastric Muscle.

In its Passage between the Jugular and Carotid it sends down a Ramus to the jugular Glands, Musculus Cutaneus, &c. and behind the first Ganglion of the Intercostalis it detaches another, which descends till it joins the Nerve of the eighth Pair, or Sympatheticus Medius: Afterwards it gives off a third to the Musculus Omo-Hyoïdæus, Sterno-Hyoïdæus, and to the small Muscles of the Larynx.

Afterwards this Trunk of the ninth Pair bends near the Angle of the inferior Maxilla, and runs forwards between the Musculus Cerato-Basio-Glossus and Mylo-Hyoïdæus, under the Genio-Glossus; to all which Muscles it gives Filaments, and is afterwards lost in the Tongue, communicating with the Filament of the Ramus Lingualis of the inferior maxillary Nerve, and with the Ramus of the same Name belonging to the eighth Pair.

Before it bends near the Angle of the inferior Maxilla, a little below the Apophysis Styloïdes of the Os Temporis, it communicates with the first cervical Pair, and then sends a small Ramus to the Larynx, and another more considerable one, which descends behind the Musculus Sterno-Mastoïdæus on the anterior cervical Muscles, and communicates with the first and second vertebral Pairs.

This last Ramus likewise communicates with the Portio Dura of the auditory Nerve and the following vertebral Pairs; after which it terminates

nates chiefly in the Musculus Sterno-Hyoidæus and Sterno-Thyroidæus.

NERVI SUB-OCCIPITALES, or those of the tenth Pair, arise a little lower, and more laterally, than the former, at the Extremity of the Medulla Oblongata, opposite to the posterior Part of the condyloid Apophyses of the Os Occipitis.

They come on each Side from the anterior Part of the Medulla, by a single Plane of small Filaments, and communicate, by some collateral Filaments, with the first cervical Pair, before they pierce the Dura Mater.

They enter the Dura Mater directly outwards, opposite to their Origin, at the same Place where the vertebral Arteries perforate it internally; both going, in a Manner, thro' the same Foramina and the Nerves lying below the Arteries.

Afterwards they descend in the Duplication of the Dura Mater, and egress under the Margin of the great occipital Foramen, crossing the Elongation or occipital Funnel of that Membrane.

Having passed out of the Cranium, each of them runs to the posterior Scissure of the superior oblique Apophysis of the first cervical Vertebra, in which it runs from behind anteriorly, in Company with the vertebral Artery, that lies above it in the same Scissure.

Where it leaves this Scissure it forms a Ganglion, and gives Filaments to the Musculi Recti and Obliqui of the Head, besides one which descends in the transverse Foramina of the cervical Vertebrae, along the sanguiferous Vessels that lie there.

Having formed this Ganglion, and sent off these Filaments, it turns anteriorly and inferiorly over the transverse Apophysis of the first Vertebra, forming a kind of Curvature with an ascending Ramus of the first cervical Pair.

This

This Curvature surrounds the anterior Part of the transverse Apophysis, and has several Communications with the first Ganglion of the great sympathetic Nerve; and by its convex Side adheres very closely to those of the eighth and ninth Pairs.

The superior Part of this Curvature, or Ganglion, sends up a considerable Nerve, which is increased by the Addition of a short Ramus belonging to the first cervical Pair, and running upwards and backwards on the convex Side of the Os Occipitis, is distributed to the superior and lateral Parts of the Head by several Ramifications. This Ramus is named *NERVUS OCCIPITALIS*.

These Sub-occipital Nerves have this in common with the other Nerves of the Medulla Oblongata, that each arises only by one anterior Fasciculus of Filaments, without any posterior Fasciculus, as in the vertebral Nerves. Sometimes indeed a small posterior single Filament is observed on each Side, but this seems rather to belong to the *Nervus Accessorius* of the eighth Pair, than to the tenth.

The particular Description of the Course, Division, and great Extent, of the *NERVI SYMPATHETICI MAXIMI*, commonly called *INTER-COSTALES*, will come in most properly after that of all the *VERTEBRAL NERVES*, with which they almost universally communicate.

OBSERVATIONS.

The almost universal Connexion and Communication which this Nerve has with the other Nerves of the Body, may lead us to understand the following and a great many more Phenomena, Why the too great Quantity of Bile in the Cholera occasions Vomiting, as well as Purging: Why People vomit in Colics, Inflammations, or
other

other Irritations of the Liver, or of the Ducts going from it and the Vesicula Fellis: Why a Stone in the Kidneys, or Ureters, or any other Cause irritating those Organs, should so much more frequently bring on Vomiting, and other Disorders of the Stomach, than the Stone, or any other stimulating Cause in the Bladder does: Why Vomiting is a Symptom of Danger after Child-birth, Lithotomy, and other Operations on the Parts in the Pelvis: Why the Obstructions of the Menses are capable of occasioning Strangulations, Belching, Colicks, Stomach-aches, and even Convulsions in the Extremities: Why Vesicatories applied from the Ears to the Clavicles of Children labouring under the Tussis Convulsiva are frequently of great Service: Why Worms in the Stomach or Guts excite an Itching in the Nose, or Grinding of the Teeth: And why Irritations in the Bowels of the Belly sometimes occasion universal Convulsions of the Body. MONRO.





LECTURE XXIV.

NEUROGRAPHY continued.



THE VERTEBRAL NERVES are all those which arise from the Medulla Spinalis, and egress from the great Canal of the Spine, thro' the lateral Foramina formed by the corresponding Scissures in the Vertebræ.

The original Trunk of each vertebral Nerve commonly arises by two flat Fasciculi of medullary or nervous Filaments, one anterior, the other posterior. These two Fasciculi on each Side run towards each other, and perforate laterally the Production of the Dura Mater; after which, they presently unite in a kind of Ganglion, from which the Trunk is produced.

The vertebral Nerves are reckoned also by Pairs, in the common Manner, beginning by those which pass between the first and second Vertebræ. This Enumeration agrees with that of the Vertebræ themselves; there being seven Pairs of vertebral Nerves belonging to the Neck, called CERVICALES; twelve to the Back, called DORSALES; five to the Loins, named LUMBARES; and five or six to the Os Sacrum, called SACRI.

This Distribution is fixed chiefly by the dorsal Nerves, called COSTALES; for there is exactly the same Number of these Nerves as of Ribs, and the

the first Pair of costal Nerves passes between the first and second dorsal Vertebrae.

The first Pair of CERVICAL NERVES passes between the first and second cervical Vertebrae; lying more posteriorly than the subsequent Pairs, and having larger Ganglions.

The Trunk of each of these Nerves sends out anteriorly a small Ramus, which ascends on the anterior Side of the transverse Apophysis of the first Vertebra, and forms a communicating Curvature with the small descending Ramus of the Nervus Sub-Occipitalis of the same Side; and, consequently, communicates likewise with the great sympathetic Nerve.

Posteriorly it sends out a considerable Ramus, which is soon increased by a communicating Ramus from the second cervical Pair. This Ramus communicates also with the Sub-Occipitalis, and afterwards passes between the Musculus Complexus and Rectus Minor Posticus of the Head; and, bending posteriorly, is distributed to the other small posterior Muscles of the Head, and to the Splenius, Complexus, and Trapezius. It passes next over these Muscles to the Occiput, where it is ramified posteriorly, superiorly, and anteriorly, to the Musculus Occipitalis, and Temporalis of the same Side.

It likewise gives off a Filament, which, dividing into two, sends up one Portion to the Musculus Sterno-Mastoideus, round the Nervus Accessorius Octavi Paris, or Sympatheticus Medius; and running afterwards behind that Muscle, it is distributed to the Splenius.

The other Portion of this Filament descends, and, bending in a particular Manner, communicates with the second cervical Pair and the Sympatheticus Maximus: It likewise sends smaller Filaments to the anterior Muscles of the Head and

Neck, and to the Sterno-Mastoïdæus and Splenius.

One of these small Filaments communicates with the Nervus Lingualis Major, or ninth Pair from the Brain, and goes to the Musculus Sterno-Hyoïdæus, Thyro-Hyoïdæus, and thyroïd Glands.

The second CERVICAL PAIR passes between the second and third cervical Vertebrae; and, as it egresses, communicates anteriorly with the great Ganglion of the Sympatheticus Maximus, superiorly with the first cervical Pair, and inferiorly with the third.

Afterwards the Trunk on each Side is divided into several Rami; but from the Place of its Union with the first Pair it sends off first one Filament, and then another, from where it joins the third Pair.

Lower down, these two Filaments unite into one, which descends along the internal jugular Vein; and then, forming a considerable Curvature, ascends, along the carotid Artery, as high as the parotid Gland, where it joins and communicates with the Trunk of the ninth Pair of the Medulla Oblongata. A Filament is detached from the Curvature, which is spent on the Musculus Coraco-Hyoïdæus, Sterno-Hyoïdæus, and Sterno-Thyroïdæus.

Opposite to the Sterno-Mastoïdæus the Trunk sends off a Ramus, which behind that Muscle communicates with the Nervus Accessorius of the eighth Pair, after the Manner of a Plexus.

This Ramus runs afterwards behind the Musculus Splenius, perforates the superior Portion of the Trapezius, between the great occipital Nerve and the Ear, and ascends to the lateral Part of the Occiput, where it communicates with its Fellow from the other Side. It is distributed, on each

each Side, to the Muscles just mentioned, and to the Angularis Scapulæ.

The Trunk of this second cervical Pair sends down other Rami to the middle Part of the Musculus Trapezius, Sterno-Mastoïdæus, and circumjacent vertebral Muscles; and sometimes we observe a Communication posteriorly between this Trunk and the third cervical Pair.

Having given off these Rami, this Trunk advances towards the posterior Margin of the middle Portion of the Sterno-Mastoïdæus, upon which it bends from behind anteriorly, sending out several Rami. The first Ramus runs inferiorly and posteriorly, and is distributed, by several Rami, to the Musculus Scalenus, Transversalis Colli, &c.

The second Ramus communicates with the third cervical Pair at the Place where this Pair produces the diaphragmatic Nerve, to the Formation of which it contributes. The third Ramus is only a Filament which ascending communicates with one or two Filaments of the inferior Ramus of the Portio Dura Nervi Auditorii.

The Extremitiy of this Curvature on the anterior Side of the Sterno-Mastoïdæus is divided into two Rami, one of which ascends, the other descends. The superior Ramus ascends on this Muscle to the inferior Part of the Ear, sending one Ramus behind the Ear, and another to the parotid Gland, where it joins the Trunk of the Portio Dura of the auditory Nerve, and ascends on the anterior Side of the Ear.

The inferior Ramus runs from behind forwards, to be ramified on the Musculus Cutaneus, and distributed to the Integuments of the Throat, in which it is lost near the Larynx, having first given Rami to the Musculi Sterno-Hyoïdæi: It likewise communicates with a descending Ramus of

the Portio Dura, and with another of the ninth Pair from the Brain.

Near its Origin this inferior Branch sends down a Ramus on the posterior Side of the Sterno-Mastoïdæus, gives other Rami to the jugular Glands, the Fat and Integuments of the lateral and inferior Parts of the Neck, and passes before the middle Portion of the Clavicula, below which it is lost in the lateral Integuments of the Thorax*.

The third CERVICAL PAIR passes between the third and fourth cervical Vertebrae, and communicates superiorly with the second Pair, inferiorly with the fourth, and anteriorly with the great sympathetic Nerve, and with a Filament from the ninth Pair of the Medulla Oblongata. It communicates likewise with the Nervus Accessorius of the Sympatheticus Medius by a Filament that goes to the Musculus Trapezius.

Each Trunk of this third Pair sends several Rami to the anterior, posterior, and lateral Parts of the Neck, that is, to the Muscles, Glands, Membranes, Fat, and Skin, all the way to the circumjacent superior Parts of the Thorax and Shoulder.

Among the posterior Rami, there is one which goes to the Musculus Supra-Spinatus, and, passing over the Scissure in the superior Costa of the

* To the Irritation of the Branches of this Nerve it probably is, that, in an Inflammation of the parotid Gland, the Neck is pained as far down as the Clavicle, the Head is drawn towards the Shoulder of the affected Side, and the Chin is turned to the other Side. In opening the external jugular Vein, no Venæsector can promise not to touch some of the cutaneous Branches of this Nerve with the Lancet, which occasions a sharp pricking Pain in the mean Time, and a Numbness of the Skin near the Orifice for some Time after. MONRO.

Scapula, gives Filaments to the Extremity of the Omo-Hyoïdæus; and there is another small one, which, in its Passage to the Musculus Trapezius, communicates with a Filament of the Nervus Accessorius of the eighth Pair.

Of the middle Rami, some go to the jugular Glands, the Musculi Subclavii, adjacent Portions of the Pectoralis, Deltoïdes, and Trapezius, and to the Integuments that lie thereabouts.

Among the anterior Rami there is one, which, being strengthened by a Ramus from the second cervical Pair, unites, lower down, with another Ramus of the fourth Pair, and thus forms the Nervus Diaphragmaticus.

This DIAPHRAGMATIC NERVE runs on the anterior Side of the Musculus Scalenus, and enters the Thorax behind the anterior Extremity of the Clavicula, receiving, immediately afterwards, a Filament from the first dorsal Pair, and communicating with the Sympatheticus Maximus. It descends obliquely forwards before the subclavian Artery, and on one Side of the Nervus Sympatheticus Medius, near the Origin of the Recurrent.

In the Thorax this diaphragmatic Nerve descends, immediately before the Origin or Root of the Lung, along one Side of the Pericardium, to which it adheres very closely; and then, running a little posteriorly, it soon enters the Diaphragm.

It is distributed, by numerous Ramifications, on the great Muscle of that Organ, sending likewise some Filaments to the interior Portion, by which it communicates with the great sympathetic Nerve and adjacent Plexus of the Abdomen.

The RIGHT DIAPHRAGMATIC NERVE runs along the Vena Cava Superior, and, on that Ac-

count, appears to be situated more anteriorly than the LEFT.

This LEFT DIAPHRAGMATIC NERVE lies first a little posteriorly towards the Trunk of the Aorta, and afterwards runs in a longer Course than the RIGHT, being bent, in order to pass by that Portion of the Pericardium which answers to the Apex of the Heart; for which Reason it is longer than the RIGHT: Thence it is bent posteriorly, and distributed to the Diaphragm in the same Manner with the other*.

The last FOUR CERVICAL PAIRS pass between the Portions of the Musculus Scalenus, being, in general, larger than the three former. They are united by their Trunks, and, together with the communicating Ramus of the third Pair and Trunk of the first dorsal Pair, form a very large Plexus, which is, in a Manner, inclosed in a membranous Vagina, and produces six considerable Rami, like so many particular Trunks, which are distributed to the superior Extremity, and go by the general Name of NERVI BRACHIALES.

* No Wonder, then, that an Inflammation of the Liver or Spleen, an Abscess in the Lungs adhering to the Diaphragm, or any other Cause capable of irritating the Diaphragm, should be attended with a sharp Pain, even to the Top of the Shoulder, as well as Wounds, Ulcers, &c. of this Muscle itself. If the Irritation of this Muscle is very violent, it may occasion that convulsive Contraction of the Diaphragm which is called an Hiccough; and therefore an Hiccough in an Inflammation of the Liver has been justly declared to be an ill Symptom.

An Irritation of the thoracic Nerves, which produces Sneezing, may sometimes free the phrenic Nerves from any Spasm they occasion; so that Sneezing sometimes takes away the Hiccough, and a Derivation of the Fluid of the Nerves any other Way may do the same Thing: Or the Hiccough may also be sometimes cured by drawing up into the Nose the Smoke of burning Paper, or other acrid Fumes, and by a Surprize, or any other strong Application of the Mind in Thinking or in distinguishing Objects. MONRO.

The BRACHIAL NERVES consist of six Rami on each Side; and, in the Year 1697, DU VERNAY gave to five of them the following Names; NERVUS MUSCULO-CUTANEUS, or CUTANEUS EXTERNUS, MEDIANUS, CUBITALIS, CUTANEUS INTERNUS, and RADIALIS; taking, for a Ramus of the Radialis, that Nerve which is looked upon as the sixth principal Ramus, and which is called AXILLARIS, or ARTICULARIS.

These six Rami do not arise separately; and their Origin is so complicated, that it is not an easy Matter to determine it; but, in general, it seems that each of the five vertebral Pairs, which form the great Plexus, contributes to the Formation of each brachial Ramus.

Four of these Nerves arise anteriorly from the great Plexus; viz. the Musculo-Cutaneus, Medianus, Cubitalis, and Cutaneus Internus; and the other two, the Radialis and Axillaris, arise posteriorly.

The five vertebral Pairs form the large Plexus in the following Manner:

The fourth and fifth cervical Pairs, about an Inch after they egress, unite into one common Trunk; the seventh cervical and first dorsal Pair likewise unite into one Trunk, very near their Origin; the sixth cervical Pair runs singly, for a considerable Space, between the two other Trunks, and is afterwards increased by a communicating Portion which it receives from each of them.

These five large vertebral Nerves on each Side, thus mingled, interwoven, and complicated together, divide again, and are disposed in a quite different Manner from what is ordinary; forming the six brachial Rami. There is, however, some Variety in this plexiform Union and Mixture.

The Manner in which the six brachial Nerves arise from the great Plexus, is commonly as follows :

The **NERVUS MUSCULO-CUTANEUS** is formed by the Union of the fourth and fifth cervical Pairs, and, by their collateral Communication, with the third and sixth Pairs.

The **MEDIANUS** comes, on one Side, from the Union of the sixth cervical Pair with the fourth and fifth ; and, on the other, from the Union of the seventh Pair with the first Dorsalis : These two Unions form an acute Angle, the Apex of which produces the median Nerve.

The **CUBITALIS** egresses from the Union of the seventh cervical with the first dorsal Pair, a little nearer the inferior Side of the Angle of the Medianus.

The **CUTANEUS INTERNUS** arises much in the same Manner.

The **RADIALIS** is the largest of the six, and exits from the Apex of another nervous Angle, the superior Side of which is formed by the Union of the Trunks of the fourth, fifth, and sixth Pairs ; and the inferior Sids by the Union of the seventh cervical and first dorsal.

The **AXILLARIS** arises, close to the Radialis, chiefly from the superior Side of the nervous Angle, and communicates with all the rest.

Besides the great brachial Nerves, several small Rami egress from each of the last four Pairs, which we shall describe, and the Trunks they belong to, before the Distribution of the brachial Nerves.

The **FOURTH CERVICAL PAIR** passes between the fourth and fifth cervical Vertebrae, and communicates superiorly with the third Pair, inferiorly with the fifth, and anteriorly with the great sympathetic.

It sends several Rami to the Musculus Scalenus, Angularis Scapulæ, Rhomboïdes, Trapezius, and Pectoralis Major; and likewise gives off a Filament that contributes to the Formation of the Nervus Diaphragmaticus: Afterwards it advances a Finger's Breadth without any Ramification, and joins the Trunk of the fifth cervical Pair.

At the Place of this Union, or a little before, it gives out a pretty considerable Ramus, which, having sent a Filament to the Musculus Sub-scapularis, passes thro' the small Scissure in the superior Costa of the Scapula, and gives other Filaments to the Supra-Spinatus. This Ramus runs afterwards under the last named Muscle, and under the Acromium, to the Infra-spinatus and Teres Minor.

THE FIFTH CERVICAL PAIR passes between the fifth and sixth cervical Vertebrae, communicating with the fourth and sixth Pairs, and with the Sympatheticus Majus.

Afterwards each Trunk sends anteriorly a Ramus, which, uniting with a like Ramus from the sixth Pair, is distributed to the Musculus Scalenus, Surface of the Pectoralis Major, and to the circumjacent Integuments. This Trunk likewise sends off, near its Origin, another Ramus, which descends behind the Origin of the sixth Pair, from which it receives a small communicating Filament.

Being thus strengthened, it descends on the external Side of the Thorax, and is distributed to the Muscles situated there; passing first under the two Pectorales, and then between the Serratus Major and Sub-scapularis.

Afterwards, continuing its Course inferiorly, it reaches the anterior, middle, and almost the inferior Portion of the Latissimus Dorsi, at the third
false

false Rib, and terminates in this Muscle and the Integuments.

The SIXTH and SEVENTH CERVICAL PAIRS, having passed, in the common Manner, under the sixth and seventh cervical Vertebræ, and having communicated with the other Nerves near them, send several Filaments to the adjacent Parts.

The Ramus of the sixth Pair that unites anteriorly with a like Ramus of the fifth Pair, to be distributed on the Thorax, sends down a Filament, which, together with another common to the seventh cervical and first dorsal Pair, forms a kind of Curvature, under which the axillary Artery passes.

All these Nerves give Filaments to the circumjacent Integuments, and some likewise go to the axillary Glands.

The NERVUS MUSCULO-CUTANEUS, which naturally lies on one Side of the Cutaneus Internus, arises from the Union of the fourth and fifth cervical Pairs, and partakes of their lateral Communication with the third and sixth Pairs.

Having reached the superior Extremity of the Musculus Coraco-Brachialis, it perforates it obliquely from above downwards, and gives it several Filaments; it afterwards descends on the Arm behind and under the Biceps, to both Portions of which it gives Rami.

Having got from behind the Biceps, it runs from within outwards between the inferior Extremity of that Muscle and of the Brachialis, which it likewise supplies: In the Fold of the Arm it reaches the Skin immediately behind the Vena Mediana, and there it becomes a true Nervus Cutaneus. Thence it runs along, between the Supinator Longus and the Integuments, on the internal Side of the cephalic Vein, all the way to the Thumb.

It is distributed to the Integuments on the anterior Side of the Carpus to those of the Thumb and of the convex Part of the Hand: Before it reaches the Wrist, it passes over the cephalic Vein, and communicates, at the Thumb, with a Ramus of the radial Nerve*.

NERVUS MEDIANUS lies between the Musculo-Cutaneus and Cubitalis. It arises from the Union of three Rami; one belonging to the sixth cervical Pair, one to the seventh, and one to the first Dorsalis. In some Subjects it is formed by the Union of two principal Rami, one of which comes from the Union of the first Dorsalis with the last Cervicalis, the other from the Union of the fourth, fifth, and sixth Cervicales.

It descends on the Arm, with the brachial Artery, under the internal Margin of the Biceps, having first passed behind the inferior Insertion of the Coraco-Brachialis, and reaches the Fold of the Arm between the inferior Extremity of the Musculus Brachialis and Pronator Teres; giving Filaments, in its Passage, to all these Muscles on both Sides.

It passes behind the Ramus Medianus of the basilic Vein, as it approaches the internal Condyle, and then runs posteriorly cross the Pronator Teres, and inferiorly between the Perforatus and Perforans, to which it gives Rami.

Below the Pronator Teres it sends off a particular Ramus that runs along the inter-osseous Ligament, behind the Pronator Quadratus, all the way to the Wrist, giving Filaments to that Muscle.

* On opening the cephalic Vein of the Arm at the ordinary Place, the same Symptoms are sometimes produced as in opening the external jugular Vein; and from a like Cause, to wit, from the hurting a Branch of this cutaneous Nerve with the Lancet. MONRO.

Afterwards, having detached some cutaneous Ramifications, the Trunk passes under the internal transverse Ligament of the Carpus to the Palm of the Hand, where it sends off numerous Rami to the Musculus Thenar and Anti-Thenar; two to the lateral concave Parts of the Thumb, two to those of the Index, two to those of the Middle Finger, and one to the nearest Side of the Annular Finger, after having communicated with a Ramus of the cubital Nerve. These Rami go all the way to the Extremities of the Fingers, supplying the Integuments, Ligaments, and Tendons.

NERVUS CUBITALIS arises from the Union of the seventh cervical with the first dorsal Pair, and communicates with the inferior Trunk of the median Vein.

It descends internally to the Arm, along the Musculus Anconæus Maximus, between the brachial Artery and basilic Vein, sending off only small Filaments to the adjacent Muscles and Integuments.

It runs in between the internal Condyle of the Os Humeri and the Olecranon, where it is covered only by a kind of Ligament, and by the common Integuments; and this is what makes Strokes upon the Elbow so painful, even all the way to the Little Finger, where this Nerve terminates*.

Afterwards it descends on the Musculus Ulnaris Internus, giving Filaments to the circumjacent Muscles, the Pronator Quadratus, and Integuments; and, at the inferior Extremity of the Ulna,

* Or when we lean or press on the internal Condyle of the Humerus, the Numbness and Prickling, we frequently feel, point out the Course of this Nerve. I have seen a Weakness and Atrophy in the Parts which I mentioned this Nerve to be sent to, after a Wound in the internal inferior Part of the Arm. MONRO.

it is divided into two Rami, one large, the other small.

The large Ramus, which may be reckoned the Continuation of the Trunk, passes on one Side of the Os Pisiforme, under the great transverse Ligament of the Carpus, to that Part of the Palm of the Hand that answers to the last two Fingers, where it gives some Filaments to the Integuments and Ligaments of the Carpus.

Afterwards it divides into three particular Rami, one of which forms a kind of Curvature, being distributed to the adjacent small Muscles of the Thumb, and to the Inter-ossei; the second is bifurcated, and goes to the corresponding lateral concave Parts of the Annular and Little Fingers; and the third goes to the opposite lateral Part of the Little Finger, and to the adjacent Muscles.

The small Ramus is turned externally, behind the Tendon of the Ulnaris Externus, and goes to that Part of the Back of the Hand which answers to the last two Fingers. It is distributed to the lateral convex Parts of these two Fingers, much in the same Manner as the other Ramus, to the lateral concave Parts; it likewise supplies the Musculus Hypo-thenar, Metacarpus, and the Integuments, and communicates with a Ramus of the Nervus Medianus.

NERVUS CUTANEUS INTERNUS is very small, and arises from the Union of the seventh cervical and first dorsal Pairs, but chiefly from the latter: It runs over the other brachial Nerves, and descends on the internal Side of the Arm, between the Muscles and Integuments.

It first divides into two Rami, which accompany each other very closely, as far as the internal Condyle, on one Side of the Vena Basilica, being covered by the Ramus Medianus of that Vein.

One of these Rami descends under the Integuments, that cover the *Musculus Radialis Internus* and *Ulnaris Gracilis*, and is afterwards ramified on the Skin that covers the Wrist and Beginning of the Palm of the Hand.

The other Ramus runs a little more posteriorly along the Integuments which cover the *Musculus Ulnaris Internus* and *Ulna*, upon which it is ramified all the way to the Little Finger.

NERVUS RADIALIS arises from the Union of three compound Rami; one of which comes from the united Trunks of the fourth and fifth cervical Pairs, the second from the single Trunk of the sixth Pair, and the third from the united Trunks of the seventh cervical and first dorsal Pairs.

The Trunk of this Nerve lies deeper than the rest; and it first runs from before posteriorly, bending round the *Humerus* between the *Musculi Anconæi* and that Bone.

This Curvature is oblique and contorted, answering to the Impression observable on the Bone; and above it the radial Nerve gives Rami to the three *Anconæi*, especially to the *Longus* and *Externus*: Afterwards it turns from behind anteriorly, between the *Anconæus Externus* and *Brachialis*.

It sends off from the Curvature some cutaneous Rami, the most considerable of which goes to the external Condyle of the *Humerus*, and is distributed to all the Integuments that cover the *Radius* on the anterior and exterior Sides, and to those which cover the exterior Parts of the *Carpus* and Back of the Hand, all the way to the Thumb.

At the Fold of the Arm the radial Nerve turns externally, and descends between the inferior Extremity of the *Musculus Brachialis* and superior
Ex-

Extremity of the Supinator Longus, giving Rami to these and the adjacent Muscles.

Having reached the Extremity of the Radius, it divides into two, or rather sends off a large Ramus, which passes between the Radius and Supinator Longus below the Middle of the Bone, where it runs in between the Supinator Longus and Radialis.

This Ramus accompanies the external radial Artery near the Integuments; and, having got to the inferior Part of the Radius, it is distributed, in three Rami, to the convex lateral Parts of three Fingers and an Half.

One Ramus goes to the internal lateral Part of the Thumb, and to the Integuments; the second is divided into two for the external lateral Part of the Thumb and anterior lateral Part of the Index, giving Filaments, in its Passage, to the Integuments of the metacarpal Bones; the third Ramus is divided into several lesser Ramifications which go to the posterior lateral Parts of the Index, to both Sides of the Middle Finger, and to the anterior lateral Part of the Ring Finger. Thro' all its Course this Ramus supplies the Integuments and inter-ossæous Muscles.

The Trunk or largest Ramus of the radial Nerve passes between the superior Extremity of the Radius and Musculus Supinator Brevis; and, in its Passage, supplies this Muscle, the Anconæus Minimus, Supinator Longus, and Radialis Externus.

Afterwards it is lost in the Extensor Digitorum Communis and Muscles of the Carpus and Thumb, having first communicated with a Ramus of the musculo-cutaneous Nerve.

NERVUS AXILLARIS arises from the last two cervical Pairs, and sometimes seems to be no more than a large Ramus of the Nervus Radialis. It runs

runs in the Cavity of the Axilla, behind the Head of the Humerus, between the Musculus Teres Major and Minor, and bends from within, externally and posteriorly, round the Neck of that Bone; running, between the Articulation and superior Extremity of the Anconæus Longus, to the Deltoïdes*.

It is divided into several Rami, which go chiefly to the superior and inferior Parts of the Deltoïdes, upon which they are ramified, supplying, in their Passage, the Sub-scapularis, superior Extremity of the Anconæus Longus, Teres Major and Minor, and Supra-spinatus: It likewise gives some Nerves to the Latissimus Dorsi and Anconæus Externus.

NERVI DORSALES, or COSTAL NERVES, consist of twelve Pairs, and deserve more justly to be called INTER-COSTALES than the great SYMPATHETIC NERVE, as it is sometimes called.

They have this in common with each other, that, as soon as they leave the dorsal Vertebrae, before they begin to accompany the Ribs, they send out two Filaments anteriorly that communicate with the great sympathetic Nerve and several Filaments posteriorly, to the vertebral and other Muscles.

Each of these twelve Pairs is numbered from the Vertebra under which it egresses. Thus the first Pair is that which passes under the first dorsal Vertebra, and so of the rest.

* The Situation of these brachial Nerves in the Axilla may let us see how a Weakness and Atrophy may be brought on the Arms by long continued Pressure of Crutches, or such other hard Substances, on this Part; and the Course of them from the Neck to the Arm may teach us, how much better Effects, Vesicatories or stimulating nervous Medicines would have, when applied to the Skin, covering the transverse Processes of the cervical Vertebrae, or at the Axilla, than when they are put between the Shoulders; or upon the spinal Processes in Convulsions or Palsies of the superior Extremities, where a Stimulus is required. MONRO.

The first Pair communicates with the Nervi Brachiales, and, together with the second Pair, it sends off the Rami Thoracici.

The seven superior Pairs run along the inferior Sides of the true Ribs all the way to the Sternum, being distributed to the inter-costal Muscles, which they likewise perforate from within externally, to go to the Serratus Major, Pectorales, and external Integuments.

The seventh Pair, having reached the cartilaginous Portion of the seventh true Rib, descends to the broad Muscles of the Abdomen, to which it is distributed.

The inferior five Pairs leave the Extremities of the false Ribs, and go to the Muscles of the Abdomen.

The eleventh Pair likewise gives some Filaments to the Diaphragm, and then runs in between the Musculi Transversales and Peritonæum.

The twelfth is distributed to the Transversales and Obliqui Interni.

All these Nerves send numerous Ramifications thro' the Muscles, to the Integuments that form the cutaneous Nerves of the Thorax, of the superior two Regions of the Abdomen, and of the superior Portion of the Loins*.

NERVI LUMBARES all send Filaments posteriorly to the vertebral Muscles, communicate with

* May not the Communications of all these Nerves be one Reason why the Parts they serve act so uniformly and conjunctly in Respiration, and conspire together in the convulsive Motions of Coughing, Sneezing, &c.? The twitching Spasms that sometimes happen in different Parts of the Muscles of the Abdomen, by any Irritation on the Branches of the inferior dorsal Nerve are in Danger of occasioning a Mistake in Practice, by their Resemblance to the Colic, Nephritis, &c. The Communications of these inferior ones with the Intercostals may serve to explain the violent Effort of the abdominal Muscles in a Tenesmus and Child-bearing. MONRO.

each other, and with the Sympatheticus Maximus on each Side, and are covered by the Psoas Muscle.

The Rami which communicate with the great sympathetic Nerve are long; because they advance a considerable way on the Bodies of the Vertebrae Lumbares.

NERVI LUMBARES are denominated from the Vertebrae under which they pass.

The first Pair passes between the first and second lumbar Vertebrae, and each receives a communicating Ramus from the last dorsal Pair, and gives out another to the second lumbar Pair, or to a Ramus thereof.

Each Trunk communicates with the Sympatheticus Maximus by a pretty long Ramus, and afterwards gives out three Rami, one posterior, and two anterior; whereof one is external and large, the other internal and small.

The posterior Ramus perforates the Musculus Quadratus Lumborum, runs in between the posterior Parts of the oblique Muscles of the Abdomen, pierces the Obliquus Externus, and is distributed to the Skin all the way to the Clunes: This Ramus also supplies the vertebral Muscles and Sacro-Lumbaris.

The external anterior Ramus perforates the superior Extremity of the Musculus Psoas obliquely outwards; passes over the Quadratus Lumborum, and runs along the Crista of the Os Ilium to the anterior Spine of that Bone.

It gives Filaments to the abdominal Muscles, and supplies the Fascia Lata, adjacent Integuments, and those of the anterior Part of the external Side of the Thigh, and the inguinal Glands.

The internal anterior Ramus perforates the Psoas almost at the same Place with the former, but

but a little more anteriorly; and then passes over the Musculus Iliacus to the Beginning of the Ligamentum Fallopii, where it unites with the other anterior Ramus, and, by this Union, forms a Nerve which runs along that Ligament, and along the internal Side of the Aponeurosis of the Obliquus Externus, all the way to the Aperture of that Muscle.

This Nerve egresses by that Aperture, and afterwards divides into several cutaneous Filaments, which go to the Pubis and Integuments of the Parts of Generation in both Sexes, &c. it likewise supplies the spermatic Vessels, and those vascular Cords improperly named round Ligaments.

Besides these Rami, the Trunk of this first Pair, near its Union with the second, sends out two small Rami, closely united, which descend behind the Psoas Muscle over one tendinous Insertion of the small Muscle of the Diaphragm, in the third lumbar Vertebra, and communicate with the great sympathetic Nerve.

These two Rami accompany each other in this Manner all the way to the Ligamentum Fallopii; whence one goes to the Testicles, in Company with the spermatic Vessels; the other passes under the Ligament to the Skin and Glands of the Inguen*.

At the Place of this Division the Trunk sends a Ramus directly downwards, that joins the second lumbar Pair, or rather a Ramus thereof; and

* Whoever attends to the Course of these lumbar Nerves, and of the spermatic Vessels and Nerves upon the Psoas Muscle with the oblique Passage of the Ureter over that Muscle, will not be surprised, that, when a Stone is passing in this Canal, or even when it is inflamed, the Trunk of the Body cannot be raised erect without great Pain; or that the Skin of the Thigh becomes more insensible, and the Thigh is drawn forwards; and that the Testicle often is drawn convulsively towards the Annulus of the abdominal Muscles.

afterwards contributes to the Formation of the large Ramus termed *NERVUS CRURALIS*.

The Trunks of the SECOND PAIR of LUMBAR NERVES egress between the second and third dorsal Vertebrae; and, having communicated with the first Pair, and with the great sympathetic Nerve, each Trunk gives off several small Filaments to the adjacent Parts of the *Musculus Psoas*, and a large Ramus posteriorly, to the *Quadratus-Lumborum*, *Sacro-Lumbaris*, *Longissimus Dorsi*, and circumjacent vertebral Muscles, the *Quadratus* having first been perforated by it.

Afterwards the Trunk sends out a small Ramus, which near its Origin joins a descending Ramus of the first Pair: Being thus strengthened, it perforates the Head of the *Psoas*, runs along that whole Muscle, to the Fissure of the *Obliquus Externus*, and is distributed to the inguinal Glands, to the Fat and Scrotum in Males, and to the Labia in Females.

The same Trunk sends out two other Rami, which accompany each other, and likewise a small Ramus between the Origins of these two, that goes to the superior Part of the *Psoas*: These two Rami perforate the *Psoas* in different Places; and afterwards, continuing still near each other, they pass under the superior Part of the *Ligamentum Fallopii*, and so go out of the Abdomen.

As they egress, they unite and form one Nerve, which is distributed by several Rami to the inguinal Glands, *Aponeurosis Cruralis*, and Integuments of the anterior Part of the Thigh, all the way to the Knee.

Some of these Rami unite with those of the *Nervus Cruralis*; some are distributed to the Integuments on the interior Side of the Thigh, and one accompanies the crural Artery, over one Ramus of which it runs, in Form of an Arch.

This

This Trunk sometimes sends out another Ramus, that unites with one from the third and one from the fourth Pairs, into a particular Branch, which, passing to the obturator Muscles, is named *NERVUS OBTURATOR*.

Afterwards this Trunk descends, and, having given a Ramus to the middle Portion of the *Psoas* Muscle, joins the Trunk of the third Pair, and contributes to the Formation of the crural Nerve.

The Trunks of the *THIRD PAIR* of *LUMBAR NERVES* egress between the third and fourth lumbar Vertebrae: Each Trunk communicates superiorly with the second Pair, anteriorly with the great sympathetic Nerve, and joins the Trunk of the fourth Pair inferiorly; it sends a considerable Ramus posteriorly, between the transverse Apophyses that go to the vertebral and other adjacent Muscles.

Before it unites with the fourth Pair, it sends a considerable Ramus inferiorly; and, having received a communicating Ramus from the second Pair, unites with one from the fourth Pair, and forms the obturator Nerve.

It likewise detaches another large Ramus that descends between the *Musculus Iliacus* and *Psoas*, and joins the crural Ramus on the external Side of the inferior Part of the Muscle last named. It may be reckoned a sort of *NERVUS ACCESSORIUS* to the Cruralis.

As the Trunk runs along the *Psoas* it gives off Filaments to that and the iliac Muscle, and sends down a Ramus, that passes under the *Ligamentum Fallopii*, to the *Musculus Pectinæus*; and, lastly, having joined a Ramus of the second Pair, it unites with the fourth, to form the *Nervus Cruralis*.

The Trunks of the *FOURTH PAIR* of *LUMBAR NERVES* egress between the fourth and fifth lum-

bar Vertebrae; and each communicates superiorly with the third Pair, and anteriorly with the great sympathetic Nerve, oftentimes by two Filaments.

Each Trunk sends Rami posteriorly to the vertebral and adjacent Muscles, and afterwards completes the Formation of the Nervus Cruralis, together with the other Portions of the lumbar Nerves already mentioned.

From the same Place it sends off a considerable Ramus, which, joining a Ramus from the third Pair, and one from the second, forms the Nervus Obturator.

Lastly, The remaining Part of the Trunk joins the fifth Pair of lumbar Nerves.

NERVUS OBTURATOR runs along the internal lateral Part of the Psoas Muscle to the Pelvis, and egresses from the Abdomen at the superior Part of the obturator Muscles and Foramen Ovale of the Os Innominatum.

As it egresses, it supplies the Musculi Obturatores and Pectinæus, and is afterwards distributed, by three principal Rami, to all the Portions of the Triceps; and sends other Rami, between these Portions, to the Gracilis Internus.

The FIFTH PAIR of LUMBAR NERVES passes between the last lumbar Vertebra and Os Sacrum; each Trunk communicating superiorly with the fourth Pair, and anteriorly with the great sympathetic Nerve. It sends Rami posteriorly to the vertebral and circumjacent Muscles, and even to the Glutæi; and, as it bends anteriorly, it sends a small Ramus to the crural Nerve.

Afterwards the Trunk descends on the Symphysis of the Os Sacrum with the Os Ilium, enters the Pelvis, and, having received a communicating Ramus from the fourth lumbar Pair, joins the Nervi Sacri, with which it forms a Plexus that produces the NERVUS SCIATICUS, the largest Nerve

Nerve of the human Body, which is distributed to the inferior Extremity.

NERVI SACRI are those that come from the Os Sacrum, the chief of which pass thro' the anterior Foramina of that Bone, the rest thro' the lateral Scissures at the Extremity of that Bone, and in the Os Coccygis.

These Nerves are likewise reckoned by Pairs, of which there are commonly six; four passing thro' the great anterior Foramina, and two below them. This Number is increased when there are five Pairs of great Foramina; and some Filaments likewise pass thro' the posterior Foramina.

The first Pair is very large; all the rest diminish gradually, and the last is very small.

Those that pass thro' the great Foramina, unite as soon as they enter the Pelvis, and, together with the fifth lumbar Pair, form the great Plexus for the sciatic Nerve; they likewise send Rami posteriorly thro' the Membranes of the posterior Foramina, to the adjacent Integuments.

The Trunks, thus united and interwoven with each other, give off other small Rami, besides the great sciatic Trunk; and it will be proper to describe the most considerable of these Rami, together with the inferior NERVI SACRI, before we speak of the Ramifications of the great Sciaticus.

This Disposition resembles that of the last four cervical Pairs and first Dorsalis, which are not only interwoven together, to form the brachial Nerves; but also send off many Rami from their Origin.

From this Inter-texture of the NERVI SACRI, especially from the second Pair, a Ramus egresses to the Vesiculæ Seminales, prostate Gland, Uterus, Tubæ Fallopianæ, &c. another Ramus goes chiefly from the fourth Pair, partly to the Places just mentioned, and partly to the Bladder and Intestinum Rectum.

The same Inter-texture, and chiefly the third Pair, united in some Subjects with the second, and in others with the fourth, and sometimes with both, produces a Ramus that goes out of the Pelvis over the Ligamentum Fallopii, passes on the internal Side of the Tuberosity, and interior Part of the Os Ischium, and is distributed to the Corpus Cavernosum, the Muscles thereof in both Sexes, the adjacent Parts of Generation, and to the Sphincters of the Anus.

The last two Pairs of Nervi Sacri are very small: That which egresses immediately below the great Foramina, runs from behind anteriorly, on each Side, between the Extremity of the Os Sacrum and Ligament of the Os Coccygis; being distributed chiefly to the Muscles of the Anus and circumjacent Integuments.

The last Pair of Nervi Sacri descends almost directly from the Extremity of the Canal of the Os Sacrum, and is likewise distributed to the Anus, Integuments, &c.

From the Extremity of the Plexus of all the Nervi Sacri, immediately before the Formation of the great sciatic Trunk, a Ramus egresses to the Glutæus Medius and Minimus; another egresses posteriorly, which is distributed partly to the Muscles of the Corpus Cavernosum, &c. and partly to the Glutæus Maximus and adjacent Integuments, by several Filaments, which reach as far as the Ham.



LECTURE XXV.

NEUROGRAPHY continued.

THE CRURAL NERVE, formed by the complicated Union of the Trunks of the first, second, and third Pairs of lumbar Nerves, and of a Portion of the fourth, sometimes increased by a Ramus of the fifth Pair, passes under the Ligamentum Fallopii, and egresses from the Abdomen on the external Side of the crural Artery, which lies between this Nerve and the crural Vein.

As it egresses it is divided into several Rami, some of which are detached from its Union with the Ramus Accessorius of the third Pair, but the greatest Number egresses from the Trunk itself.

The Rami which go from its Union with the Nervus Accessorius descend anteriorly on the Thigh; and, having reached the Middle of the Musculus Sartorius, follow its Course, and are spent on the Integuments of the anterior and interior Parts of the Knee.

The most anterior Ramus passes on the Fascia Lata, or Aponeurosis Cruralis, forming cutaneous Nerves all the way to the Knee.

The internal Ramus runs along the Tendon of the Sartorius, in the same Manner, all the way to its Insertion in the Tibia, where they are spent on the Integuments; and some of them go to the interior Ankle and convex Part of the Foot.

After-

Afterwards the crural Trunk divides into a great Number of Rami, which, in their Course inferiorly, are distributed to the anterior Muscles; viz. the Rectus, Vasti, and Cruralis; giving Rami, in their Passage, to the Triceps, Sartorius, Gracilis Internus, and Semi-Tendinosus.

It likewise gives off a Ramus that descends inferiorly between the Sartorius and Triceps, in the same Course with the crural Vessels, as far as the Middle of the Thigh.

Afterwards it runs near the Integuments, behind the Sartorius, to which it gives several Filaments; and continues this Course all the way to the Insertion of that Muscle.

Having reached the Tibia, it lies near the Vena Saphæna, and follows the same Course with it as far as the internal Ankle, where it detaches a great Number of cutaneous Filaments.

Lastly, It terminates, by Ramifications, on the internal and superior Part of the Foot; where one of the most anterior Ramifications adheres very closely to the Saphæna*.

NERVUS SCIATICUS being sometimes formed from the last two Pairs of the Lumbares and first three Pairs of the Sacri, runs obliquely backwards under the great Sinus of the Os Ilium, and under the Musculus Pyriformis.

It goes this way out of the Pelvis, passing between the Pyriformis and superior Gemellus; and then, running on the anterior Side of the first of these Muscles, and presently afterwards behind the

* A Branch of this Nerve runs down the internal Side of the Leg to the superior Part of the Foot, keeping near to the Vena Saphæna; an opening of which with a Lancet, at the Ankle, the Nerve is sometimes hurt, and occasions sharp Pain at the Time of the Operation, and Numbness afterwards. MONRO.

two Gemelli and Quadratus Femoris, it gives Filaments to each of them.

It descends afterwards, between the Tuberculum Ischii and Trochanter Major, along the interior and posterior Part of the Thigh, between the Musculus Biceps and Semi-Nervosus, as far as the Cavity of the Poples, a little nearer to the internal Condyle than to the external; giving Rami, in its Passage, to all these Muscles, and to the Triceps, and diminishing gradually in Size as it descends.

As it goes out of the Pelvis it gives a Ramus that passes between the Portions of the Ligamentum Sciaticum to the Anus, Perinæum, Parts of Generation, &c. and this Branch joins a Ramus from the third Pair of the Nervi Sacri, that goes to the same Parts.

As it passes between the Tuberosity of the Ischium and Trochanter Major, it produces two Rami, one of which is spent on the Glutæus Maximus, the other divides into two for the other two Glutæi.

Below the Trochanter Major, where it may be termed NERVUS SCIATICO-CRURALIS, it sends back a Ramus, that descends with the sciatic Vein, and is distributed to the Integuments as low as the Middle of the Calf of the Leg, and sometimes lower towards the external Malleolus.

The sciatic Nerve, having reached the Ham, is commonly called NERVUS POPLITÆUS, and begins to be divided into two Rami, which at first run very close to each other between the Extremities of the Biceps and Semi Nervosus, and afterwards separate gradually, passing behind the Condyles of the Os Femoris, between the superior Extremities of the Gastrocnemii.

The interior of these two Rami is very large, the exterior not so large: They are distributed to the

the whole Leg; and thro' this Course they may be termed *NERVI SCIATICO-TIBIALES*.

The large Ramus of the *SCIATICO-CRURALIS*, or *CRURALIS INTERNUS*, which may likewise be termed *POPLITÆUS INTERNUS*, descends behind the *Musculus Poplitæus* on one Side of the *Tibialis Gracilis*, commonly called *PLANTARIS*, and between the two *Gastroc-nemii*.

Afterwards it pierces the superior Extremity of the *Solæus*, and descends between this Muscle and the great Flexors of the Toes, to the inferior Extremity of the *Tibia*, near the internal *Malleolus*.

In its Passage it sends small Rami to the Articulation of the Knee, the *Gastroc-nemius Internus*, the other Muscles last mentioned, and to the Integuments, all the way down.

Besides these small Rami, it sends off another more considerable Ramus towards its superior Part, from which, one Filament goes to the *Tibialis Posticus*, another perforates the inter-ossæous Ligament, and is distributed to the superior Part of the *Tibialis Anticus*.

Soon after this it detaches externally a long Ramus, that descends posteriorly on the Leg between the Integuments and external *Gastroc-nemius*, on one Side of the *Vena Sciatica*, or *Saphæna Externa*.

This long Ramus joins a Branch of the *Sciaticus Externus Minor*, sends off Filaments towards each Side; thro' its whole Course, and, having supplied the *Tendo Achillis*, passes behind and under the external *Malleolus*.

This Ramus passes afterwards on the external Side of the Foot, where it is distributed to the Integuments and adjacent Muscles, and terminates on both Sides of the Little Toe, and externally on the Toe next to that.

The

The great sciatic Ramus, or Sciatico-Tibialis, having given off these different Ramifications, passes behind the internal Malleolus thro' a particular annular Ligament, and descends to the great lateral Sinus of the Os Calcis, passing first between that Bone and the Musculus Thenar, and then between it and the posterior Insertion of the Flexor Digitorum Brevis.

At this Place, having first sent small Filaments to the circumjacent Parts, it divides into two Rami, named Nervi Plantares; one internal and large, the other external.

The Nervus Plantaris Internus is distributed to the Foot, much in the same Manner as the radial Nerve to the Hand: It runs first along the internal Side of the Sole of the Foot, and sends Filaments to the Thenar, Flexor Digitorum Brevis, and to the Musculus Lumbricalium Accessorius.

Afterwards it sends four Rami to the lateral concave or inferior Parts of the first three Toes, and to the nearest lateral Part of the fourth Toe. The first Ramus goes to the interior Side of the Great Toe; the second divides into two, for the corresponding Sides of the Great Toe and the Second; the third, being bifurcated in the same Manner, goes to the Second and Third Toes; and the fourth to the Third and Fourth Toes.

These Nerves communicate on each Side at the Extremities of the Toes, and, in their Passage, give Filaments to the Musculi Lumbricales, Inter-ossei, and adjacent Ligaments and Integuments.

The external Plantaris passes between the Musculus Lumbricalium Accessorius and Flexor Digitorum Brevis, giving Filaments to these Muscles, the Inter-ossei, and to the hypo-thenar Minimi Digiti; and afterwards it divides into two Rami.

The first Ramus runs in the Interstice between the last two Toes, and, being divided, goes to the corresponding lateral Parts of both; the other Ramus goes to the inferior external lateral Part of the Little Toe.

During this Course, the external Nervus Plantaris supplies the Aponeurosis Plantaris, and the Ligaments and Integuments in the same Manner as the rest.

The small sciatic Ramus, or Sciaticus Externus, called likewise Sciatico-Peronæus, runs externally over the Head of the Fibula; and is divided into several Rami, among which there are three or four considerable; one posterior, one superior and anterior, one internal and anterior, and one external and anterior.

The posterior Ramus descends between the Integuments and the Fibula, as low as the external Malleolus, and terminates in the external Side of the Foot, having detached several cutaneous Filaments in its Passage.

About the Middle of the Fibula, it sends out a small Ramus, which joins another Ramus from the large or tibial Ramus of the sciatic Nerve, and is distributed, together with it, in the Manner already said.

The posterior Ramus of the small sciatic Branch, having reached the external Malleolus, ascends a little way on the Foot towards the Root of the Fourth Toe, where it divides into two smaller Rami.

One of these Rami divides into two others, for the corresponding lateral Parts of the Third and Fourth Toes; the other goes to the external lateral Part of the Fourth Toe, where it joins a Ramus of the external Nervus Plantaris, which is distributed to the last two Toes.

After having sent off the posterior Ramus, the small sciatic Branch runs externally over the Head of the Fibula; and, having given some Filaments to the *Gastroc-nemii* and *Solæus*, it runs cross the superior Extremity of the *Peronæus Posticus* from behind anteriorly.

Afterwards it passes between the Bone and the Muscle last named, and sends several Filaments anteriorly to the adjacent Parts, and then produces the three or four Rami already mentioned, which are distributed in the following Manner:...

The superior and anterior Rami run a little transversely between the Head of the Fibula and superior Extremity of the *Extensor Digitorum Longus*; and, having given Filaments to this Muscle, and to the *Extensor Pollicis Longus*, it is distributed to the superior Extremity of the *Tibialis Anticus*, giving Filaments to the adjacent Integuments.

The internal anterior Ramus descends anteriorly on the inter-osseous Ligament, between the *Extensor Pollicis Longus* and *Tibialis Anticus*, giving Filaments to each of these Muscles.

It passes afterwards under the annular Ligament of the *Extensor Muscles*, behind the *Extensor Pollicis*, to the superior Part of the Foot, under the *Extensor Digitorum Brevis*: In its Passage it gives Filaments to that Muscle, and to the first superior *Inter-ossei*.

Having communicated, by a Filament, with the external anterior Ramus, it is spent on the corresponding lateral Parts of the first two Toes.

The external anterior Ramus of the small sciatic Branch descends between the Fibula and *Peronæus Longus*, and then between the *Peronæus Medius* and *Extensor Digitorum Longus*; to which, and the adjacent Ligaments, it gives Filaments

aments all the way to the superior Side of the Foot.

In this Course, having run along above two third Parts of the Leg, and reached the great annular Ligament, it runs anteriorly and towards the Integuments, being there divided into two Portions, one of which goes to the Great Toe, the other to the last Toes.

The first Portion of this Ramus gives a Nerve to the internal lateral Part of the Great Toe, after which it is distributed to the circumjacent Integuments on the convex Side of the Foot, and, lastly, to the corresponding lateral Parts of the Great and Second Toes.

The other Portion, which goes to the last Toes, is joined first to a Filament of the first Portion, and then to another from the internal anterior Branch.

After this Union, they are presently divided, and distributed to the two last Toes, and to the Integuments. One Filament, arising from this Union, joins a Ramus belonging to the great sciatic Branch*.

NERVI SYMPATHETICI MAXIMI, commonly named INTERCOSTALES, begin by a Filament from the sixth Pair belonging to the Medulla Oblongata, and by two Filaments from the fifth

* By applying what was said of the Nerves in general to the particular Distribution of the Nerves of the inferior Extremities, we may see how People with fractured Legs, especially where there are Splinters, should be so subject to convulsive Startings of the fractured Member: Why, upon tying the Blood-vessels in an Amputation of the Leg, the Patients should sometimes complain of violent Pain in their Toes: Why such Patients should also be troubled with Startings: And why, for a considerable Time after the Amputation of the diseased Limb, when the Suppuration is well advanced, they should complain of Pain in the Sore which occasioned the Amputation.

Pair; and these Filaments do at first compose a very small Nerve which runs posteriorly, to go out of the Cranium thro' the osseous Canal of the Apophysis Petrosa, and increase gradually in their Course inferiorly.

But WINSLOW having examined attentively the pretended Origin of these Filaments, they seem to him rather to ascend from the Basis of the Cranium with the internal Carotid, and to run from behind anteriorly to join the fifth and sixth Pairs; and he found the Angle, formed by this Union, to be turned anteriorly; and withal so very acute, that these Nerves cannot be looked upon as Recurrents.

WINSLOW has, ever since that Time, that is, for above forty Years past, found this Angle disposed the same way in all the Subjects which he has dissected; he therefore is of Opinion, that what had been taken for the original Root and descending Stem of the Nerve called INTER-COSTALIS, was really an ascending Branch thereof; which, as it enters the Cranium, is divided into Filaments, by which it becomes closely united with the two Pairs already named.

The Observation communicated to the ROYAL ACADEMY by Dr. PETIT, concerning the different Size of the Portions of the sixth Pair, appears to be indisputable; he having found this Nerve larger on the anterior Part, between the Filament of the supposed Intercoastal and the Orbit, than on the posterior Part between the same Filament and the Origin of the sixth Pair: And his Experiments concerning the real Co-operation of this Nerve in Vision, are still a farther Confirmation of the Observation.

These Nerves, as we have said, are commonly called INTER-COSTALES, tho' the Name does not agree either with their Situation, or the Extent of

their Course; and therefore the Name of SYMPATHETICI MAJORES, or MAXIMI, will be more proper, because of their frequent Communications with most of the other principal Nerves of the Body.

The Situation of these two Nerves in general, is on the lateral Parts of the whole twenty-four Vertebrae, immediately before the Roots of the transverse Apophyses, and likewise on the lateral Parts of the internal Side of the Os Sacrum.

Through this large Extent they appear like two Trunks divided, and, in a Manner, intersected, at different Distances, by a great Number of gangliform Tubercles, by means of which they communicate posteriorly with the Ganglions of the Medulla Spinalis by short collateral Filaments; and produce anteriorly all their particular Ramifications.

These Ganglions differ, more or less, from each other, in Size, Colour, and Consistence; and may be looked upon as so many Origins or Germina dispersed through this great Pair of Nerves, and, consequently, as so many little Brains.

Therefore we need only consider these Ganglions in the same Manner that we did the vertebral Nerves, as divided into Cervicalia, Dorsalia, Lumbaria, and Sacra; without pretending to determine the Number contained in each Class.

The first cervical Ganglion is the most considerable in Size, but not in Consistence, representing a soft oblong Tumor of the Figure of an Olive, and situated longitudinally before the Root of the transverse Apophyses of the first three Vertebrae, immediately behind the Pharynx.

It produces from its superior Extremity a small soft Nerve, which ascends with the internal carotid Artery of the same Side, into the osseous Canal of the Apophysis Petrosa.

At its Entrance into this Canal it is divided into several plexiform Filaments, which at that Place surround the carotid Artery, and accompany all the Incurvations thereof till it enters the Cranium. They adhere very closely to the Artery, and both they and their Trunks are very tender, having oftentimes neither the Colour nor Consistence of nervous Filaments; for they are reddish, and sometimes, in a Manner, mucilaginous. We must not mistake, for these plexiform Filaments, some lacerated Portions of the Dura Mater which line this osseous Canal.

Among these Filaments there are two or three principal ones which appear to be only a simple Division of the Trunk, and which, as they enter the Cranium, unite again into a small Trunk, more solid than the former: The small superior Trunk is immediately afterwards divided into Filaments, one of which is united to the Nerve of the sixth Pair, the rest join the fifth Pair. The Filament which goes to the sixth Pair is commonly single, but WINSLOW has sometimes found it double, or divided all the way to the Union.

Immediately below the inferior Orifice of the osseous Canal of the Apophysis Petrosa, and thence all the way down to the occipital Condyle on the same Side, or to the Top of the first Ganglion, the small ascending Trunk is a little stronger, and not altogether so soft as it is in the Canal.

The first cervical Ganglion is of a middle Consistence, and adheres very closely to the Trunk of the eighth Pair, or Nervus Sympatheticus Medius, by numerous small communicating Filaments.

It likewise communicates on both Sides, by short Rami, with the ninth and tenth Pairs of Nerves of the Medulla Oblongata; with the first, second, and sometimes the third, cervical Pairs;

and also with that Ramus which the eighth Pair sends to the Pharynx.

In its Passage it gives Filaments to the Pharynx, the small adjacent Muscles, and to the carotid Artery, from which it receives very fine capillary Vessels, which are very visible in Inflammations, and seem to form a curious reticular Work with the nervous Filaments.

Lastly, It sends inferiorly a very long nervous Filament, which runs in the Thorax, and joins other Filaments.

This Ganglion terminates inferiorly in a small Trunk, which descends on the anterior vertebral cervical Muscles, in the same Course with the eighth Pair and the carotid Artery of the same Side, to both which it is connected by membranous Expansions, as by a kind of Vagina, all the way to the last cervical Vertebra.

In this Course the descending Trunk communicates on the external or posterior Side with the third, fourth, fifth, and often with the sixth cervical Pairs, by short Rami, more or less oblique, by which it seems to be gradually increased in Size.

At the Places of these Communications we observe small Ganglions in this Trunk, which, however, in some Subjects, are scarcely perceptible; and it is very difficult to determine by which Extremity these Rami arise, and by which they are inserted.

On the interior or anterior Side, this Trunk gives off two or three Filaments which run obliquely downwards, towards the Aspera Arteria, into the Thorax; another Filament goes off below the first cervical Ganglion, which passes anteriorly on the carotid Artery, and joins a Filament of the eighth Pair, with which it forms a small distinct Trunk.

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This small Trunk runs before the subclavian Vein, and lower down joins another Filament which arises behind the subclavian Artery, and descends, sending off Filaments, in its Passage, to the Oesophagus and Parts adjacent.

The Trunk, having reached as far as the last cervical Vertebra, forms a small Ganglion called *GANGLION CERVICALE INFIMUM*, which is pretty solid; and sometimes double.

Immediately afterwards the Trunk turns from within externally towards the Radix of the first Rib, behind the subclavian Artery, where it forms a pretty large Ganglion, which is the first of the Thoracica, or Dorsalia.

These two last mentioned Ganglions are very near each other, being separated only by a very short Portion of the Trunk, which is sometimes double, and forms a kind of small Plexus, behind the subclavian Artery.

From the anterior Part of the inferior cervical Ganglion a small nervous Branch egresses, which runs before the subclavian Artery, bends immediately downwards, and terminates in the Apex of the first dorsal Ganglion, forming, by this Course, a sort of nervous Curvature, which incloses the subclavian Artery.

These two Ganglions communicate by short Rami, more or less oblique, with the adjacent vertebral Nerves, that is, with the sixth and seventh cervical Pairs; and sometimes with the fourth, by a long descending Filament: The first dorsal Ganglion likewise communicates with the first dorsal Pair of Nerves.

The lowest cervical, and sometimes the first dorsal Ganglion, sends down a communicating Filament to the recurrent Nerve of the eighth Pair; and from this Union a Filament is detached, which passes behind the common Trunk of the

axillary and carotid Arteries, joins another Filament from the eighth Pair, and contributes to the Formation of the Plexus Pulmonaris.

From the small plexiform Portion of the Trunk which joins the last cervical and first dorsal Ganglions, behind the subclavian Artery, a particular Filament egresses, which unites with the small Trunk, common to the Sympatheticus Major, and to the eighth Pair, and descends before the subclavian Artery, and, together with this Filament, composes the Plexus Cardiacus.

On the right Side, this Filament descends to the right Ventricle of the Heart, and then between the Aorta and Arteria Pulmonaris, where it communicates with some Filaments from the left Recurrent of the eighth Pair.

On the left Side a Filament egresses from the last cervical, and another from the first dorsal or thoracic Ganglion, which unite to form a kind of Curvature, in which, however, nothing is contained.

From this Curvature a Nerve egresses, which descends between the Curvature of the Aorta and the left Ramus of the pulmonary Artery, where it communicates with a Filament of the eighth Pair, and forms a gangliform Plexus, with the like communicating and united Filaments from the right Side.

From this gangliform Plexus, which may be looked upon as the Origin of the Plexus Cardiacus Superior, a great Number of Filaments descend over the Trunks of the great sanguiferous Vessels, and over the Auricles and Ventricles of the Heart.

The chief of these Filaments run in the cellular Substance behind the Aorta, or between that and the Trunk of the pulmonary Artery, where they are divided into a great many small Nerves, which

which run before and behind the Aorta, to the Basis and Auricles of the Heart.

The Filaments which descend from the Trunk itself, between the first and last cervical Ganglions, are united and interwoven in the Thorax, with the Filaments common to the last cervical and first dorsal Ganglions, and thus contribute to the Formation of the Plexus Cardiacus, and some Part of the Plexus Pulmonaris.

The long Filament of the first cervical Ganglion likewise contributes to these Plexus. It runs along the interior Side of the Trunk, and then unites with the Filaments of the last cervical and first dorsal Ganglion, and the great recurrent Nerve.

From all these Conjunctions a particular Nerve is formed, in some Subjects, which meets a like Branch from the other Side behind the Aorta; and forms, together with that, a kind of subordinate Trunk, about a Finger's Breadth in Length, which sends out, on all Sides, several Filaments which are distributed to the Parts adjacent.

From the first dorsal Ganglion the Trunk descends anteriorly on the Heads and Necks of all the Ribs, over the articular Ligaments by which they are tied to the Vertebrae. On the last false Rib it bends a little towards the Bodies of the Vertebrae.

In this Course the Trunk forms a small Ganglion between each Rib, and communicates posteriorly by two short Filaments, more or less oblique, with the corresponding dorsal or costal Nerves.

Of these two communicating Filaments, one is more oblique, and often smaller, than the other; one runs posteriorly towards the nearest Ganglion of the costal Nerve, the other runs anteriorly

riorly on the Head of the Rib, to the Trunk of the great sympathetic Nerve; and, for this Reason, one of these Filaments appears to be more anterior and longer than the others.

Having reached about half way between its Entry into the Thorax and the last dorsal Vertebra, this Trunk commonly sends five Rami obliquely downwards on the lateral and a little towards the anterior Part of the Bodies of the Vertebrae.

The first four Rami commonly come from the fifth, sixth, seventh, and eighth thoracic Ganglions; and the fifth arises from several of the following Ganglions; the first is the longest, and the last the thickest.

All these Rami approach each other gradually in their Descent as far as the last dorsal Vertebra, where they unite into one large short collateral Trunk, which pierces the superior lateral Part of the inferior Muscle of the Diaphragm, sending some Filaments to the superior Side.

Having descended below the Diaphragm, and given off some Filaments to the inferior Side of that Muscle, this great Trunk produces behind the Glandula Renalis a kind of irregular Ganglion of a curve oblong Figure, called GANGLION, or PLEXUS SEMI-LUNARIS.

The convex Side of this semi-lunar Plexus, or Ganglion, is turned obliquely backwards and inferiorly, the concave Side forwards and upwards, one of its Cornua being turned superiorly, the other anteriorly; so that the inferior Cornua of the two Ganglions on each Side are turned towards each other.

These Ganglions on each Side communicate, behind the Stomach, on the coeliac Artery, and likewise with the eighth Pair, or Nervus Sympatheticus

theticus Medius, chiefly by means of the Nervus Stomachicus Posterior belonging to that Pair.

From the reciprocal Communication of these two semi-lunar Ganglions, a kind of middle Plexus is formed, which partly surrounds the cœliac Artery, and is partly spent on the Mesocolon.

The semi-lunar Ganglion on the right Side, together with a large Portion of the Plexus Cœliacus, and some Filaments of the Plexus Stomachicus, forms a particular Intertexture called PLEXUS HEPATICUS.

This hepatic Plexus, having communicated with some Filaments of the diaphragmatic Nerve, produces several Filaments which surround the hepatic Artery and Vena Portæ in Form of a reticular Vagina, and accompany the Rami of these Vessels thro' the whole Substance of the Liver. The hepatic Plexus likewise supplies the Vesicula Fellis, Ductus Bilarii, Duodenum, Pancreas, and Glandulæ Renales.

The left semi-lunar Ganglion, formed by the anterior or collateral Trunk of the left Side, produces several Rami, which form the Plexus Splenicus, as before.

This Plexus Splenicus, having communicated with the Hepaticus, and, by the Intervention of the Plexus Stomachicus, with the eighth Pair, surrounds the splenic Artery, supplies the Pancreas, and is distributed to the Spleen.

This left Ganglion is sometimes accompanied by another, which gives Filaments to the Spleen.

Each semi-lunar Ganglion sends Rami from its convex Side, which, being joined to the Filaments of the first lumbar Ganglions, form an Intertexture called PLEXUS RENALIS, which surrounds the renal Artery, is distributed to the Kidneys and
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Glandulæ Renales, and sends out a Filament that accompanies the spermatic Vessels.

This renal Plexus concurs likewise with the semi-lunar Ganglion in the Formation of the great mesenteric Plexus, and communicates, by several Filaments, with the Plexus Coronarius Stomachicus.

The right renal Plexus communicates particularly with the Plexus Hepaticus, the left with the Splenicus, and each of them, by two Filaments, with the true Trunk, on the Side of the first two lumbar Vertebrae. This Portion of the principal Trunk is commonly called the inferior Cord of the intercostal Nerve.

The right and left semi-lunar Ganglions send nervous Fasciculi to each other, which, by a particular Intertexture, form a kind of flat Ganglion, or Plexus, immediately under the Diaphragm, before the Articulation of the last dorsal with the first lumbar Vertebra.

From this plexiform Union, commonly called PLEXUS SOLARIS, several Filaments are detached, in a radiated Manner, to the Meso-colon and Mesentery; and some of them likewise go to the Diaphragm.

A great Number of other Filaments go likewise from it, which, with the Ramifications thereof, form a kind of nervous Capsula, or Vagina, round the superior mesenteric Artery, and round all its Ramifications on the Intestines, and supply the mesenteric Glands. This is termed PLEXUS MESENTERICUS SUPERIOR, which comes chiefly from the Filaments of the Plexus Hepaticus and Renalis, and of the right semi-lunar Ganglion.

The superior mesenteric Plexus sends down from its Origin, along the Aorta, and behind the descending Portion of the Meso-colon, between the superior and inferior mesenteric Arteries, several

Filaments, or nervous Fasciculi, differently interwoven, from which a nervous Vagina is likewise formed which surrounds the inferior mesenteric Artery, and its Ramifications on the Intestines. This has been named *PLEXUS MESENTERICUS INFERIOR*.

The descending nervous Fasciculi, between the two mesenteric Arteries, which may be named *MESENTERICI POSTERIORES*, receive some communicating Filaments from both *Plexus Renales*, and likewise communicate with the Trunk of the great sympathetic Nerve, by Filaments which descend obliquely from the lumbar Ganglions; afterwards they detach a Filament, on each Side, which accompanies the spermatic Vessels.

The Fasciculi *Mesenterici Posteriores*, having produced the *Plexus Mesentericus Inferior*, send other Filaments inferiorly over the Extremities of the Aorta, behind the inferior Curvature of the Colon.

These inferior Fasciculi, or Filaments, adhere strongly to the adjacent Parts of the Peritonæum, and, together with other Filaments from both Sides of the Trunk, form a third Plexus, which may be called *INFRA-MESENTERICUS*, or *HYPOMASTRICUS*.

This hypo-gastric Plexus, at the Extremity of the last Curvature of the Colon, on the anterior Side of the last lumbar Vertebra, is divided into two flat Ganglions which surround the Beginning of the Intestinum Rectum posteriorly, to which they are afterwards distributed, and also to the Bladder and to the spermatic Vessels; and having communicated, by lateral Filaments, with each Trunk of the great sympathetic Nerve, they send Filaments to all the Parts contained in the Pelvis.

The Trunk of the great sympathetic Nerve, having detached the five Rami which form the
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collateral Trunk, becomes much smaller; and, having reached the eleventh dorsal Vertebra; it approaches the collateral Trunk, and perforates the inferior Muscle of the Diaphragm.

Afterwards it runs, more anteriorly, on the Bodies of the Vertebrae, and increases by the Addition of Filaments from the last two dorsal Pairs of Nerves.

It descends, between the Psoas and adjacent Tendons of the small Muscle of the Diaphragm, on the lateral Parts of the Vertebrae Lumbares and anterior Side of the Os Sacrum.

At this Place the right and left sympathetic Trunks approach each other, and, at the Extremity of the Os Sacrum, they form a Communication in manner of an inverted Arch.

In its Passage, each Trunk commonly receives two Filaments from each Ganglion of the Nervi Lumbares and Sacri, and likewise forms small Ganglions between each Vertebra, which send some Filaments to the circumjacent Parts, and others which communicate with the Fasciculi of the Plexus Mesenterici.

The Pairs of Filaments which come from the two or three first lumbar Ganglions run a little inferiorly, but the following run gradually superiorly; and it ought to be observed, that capillary sanguiferous Vessels are discernable between and upon the Filaments of each Pair.

The inverted Arch, or inferior Union of the two Trunks, gives off, together with the two lowest Nervi Sacri, several Filaments to the Rectum, Anus, and Muscles of the Coccyx.

Lastly, The great sympathetic Nerve, from the first cervical Vertebra to the Extremity of the Os Sacrum, communicates, by Filaments, with all the vertebral Nerves, as has been already said; but it must be observed, that, in the Thorax, these

these communicating Filaments are very small and slender, where the sympathetic Trunk is largest; and that below the Diaphragm they are stronger, because there the Trunk diminishes, especially on the Os Sacrum, where it is very small. The same Thing is to be observed concerning the Ganglions of the Trunk, the first cervical Ganglion only excepted.

N. B. The Rami of the four last cervical Nerves, and of the first dorsal, which are bestowed on the superior Extremity, and the two Crurals, with the Sciatic, which are distributed to the inferior Extremities, are much larger proportionally to the Parts they serve, than the Nerves of the Trunk of the Body, and especially of the Viscera there; and for a very good Reason, that, in the most common necessary Actions of Life a sufficient Quantity of Fluid, on which the Influence of Nerves seems to depend, may be supplied to the Muscles there, which are obliged to perform so frequent and violent Contractions.

The Size of the Nerves of the inferior Extremities seems proportionably larger than in the superior Extremities, the inferior Extremities having the Weight of the whole Body to sustain, and that frequently at a great Disadvantage. What the Effect is of the Nerves here being injured, we see daily, when People happen, by sitting wrong, to compress the sciatic Nerve, they are incapable, for some Time after, to support themselves on the affected Extremity; and this is still more remarkable in the Sciatic or Hip-Gout, in which the Member is not only weakened, but gradually shrivels and wastes. MONRO.







